

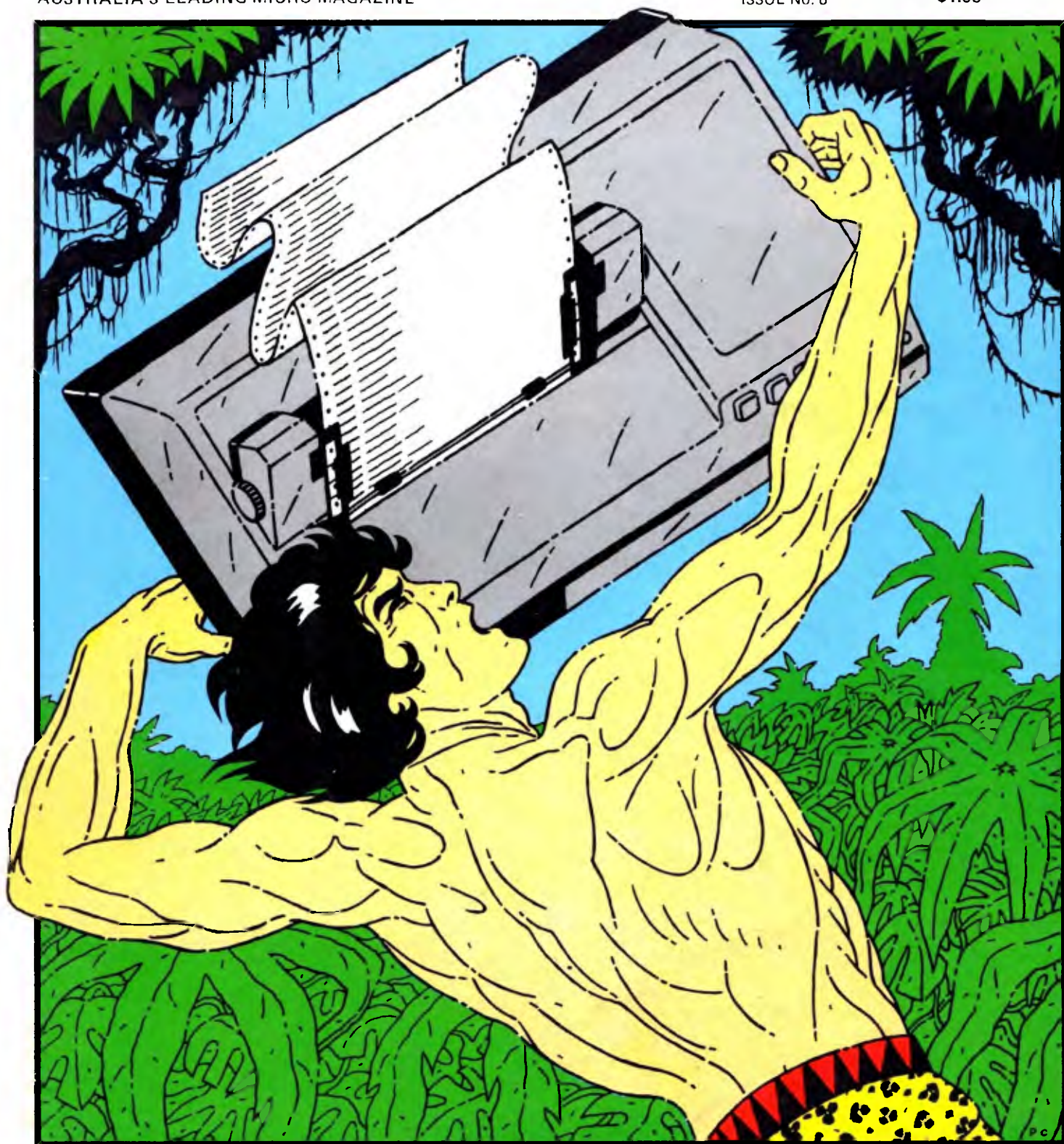
AUSTRALIAN Personal Computer

THE
SUPERPET
BENCHTESTED

AUSTRALIA'S LEADING MICRO MAGAZINE

ISSUE No. 6

\$1.95



HACKING THROUGH THE PRINTER JUNGLE
A 'Jane's Guide' to all the options

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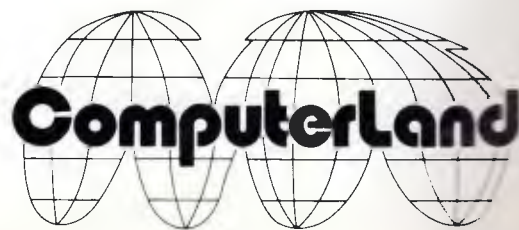
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will try to represent a balanced,
though independent viewpoint.
Finally, before submitting an
article, please check it through
thoroughly for legibility and
accuracy.

EDITORIAL

We're a fairly self-effacing lot down here at APC, but there are some things you just can't help bragging about. Since we started in May, our readership figures have been rising steadily. But this month they've stopped rising steadily. Instead, they've taken a hefty leap and our distributors have asked us to double the number of copies printed, and immediately.

This month's Sinclair ZX80 competition is designed to motivate you to write in about your opinions, instead of just vaguely muttering to yourself. We're obviously doing something right, but we want to know exactly what you like and what you hate.

Yet again we're calling for programs, especially routines and bits of information about various computers. Our

readership must be pretty literal minded because we've received lots of programs for the more exotic computers but those for the more common type have been falling off. In saying we want more of one kind we don't want everyone else to get all hurt and go quiet on us. So this time, how about some more programs for the garden variety type of computer!

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Sound incredible? The ARCHIVES BUSINESS COMPUTER is that and more!

It's a business assistant. One that never forgets, never loses reports, makes efficient use of its time and is completely trustworthy.

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There is no question that the major area restricting your business growth is in the office. This is one place where employee efficiency is still in the dark ages - requiring the handling of paper, forms and files. What you really need is not the physical presence of obsolete forms and letters, but the information and data they contain. You need the Archives Business Computer.

The Archives Business Computer offers you an economical way to individualised computing power. You can take it anywhere there's work to be done. Plug it in, turn it on, and it's working for you giving you instant access to the information you need.

Designed especially for a small business or single department in a large corporation, the Archives Business Computer is a system you can understand and use with a high degree of efficiency without being a computer specialist.

Incorporating quality and reliability the Archives Business Computer provides you with today's and tomorrow's best value in a computer system. The Archives Business Computer is a system to help your business grow.

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FEATURES

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744K Bytes Storage (Standard)
1½ Megabytes Storage (Optional)
12" Green Phosphor Monitor
25 Lines x 80 Display
CP/M Operating System
Selectric Style Keyboard
S100 Expansion Inbuilt
Microprocessor Keyboard
240 x 100 Graphics Format
Numeric Keypad and Function Keys.

SOFTWARE

Microsoft Fortran
Microsoft Basic
Microsoft Cobol
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Property Management
Word Processing System
Microsoft Basic Compiler



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Miriam Cosic and associates present the latest world-wide micro news.

OURS is not to wonder why

The Sharp MZ80K has been out for a year but it isn't being sold in Australia or, for that matter, the US. Our queries to Sharp have been met with rock-like silence. But I've unearthed some background information which may shed enough light on the matter for us all to realize that we don't know what's going on.

Tandy sells a hand held computer which is actually made by Sharp. Sharp sells the same computer under its own name as the PC-1211, but not in Australia. Presumably this is because Tandy sells theirs here. Yet, in England, Sharp markets the PC-1211 alongside Tandy's computer (and for less!)

Still with me? Right. Another piece of information of dubious relevance is that the Z80 microprocessor in Sharp's MZ80K is made in Japan by Sharp, under licence to Zilog who don't want products using the Z80 sold in America. Which explains why the MZ80K isn't being sold in the US but not why it isn't being sold here.

Tandy doesn't sell a MZ80K clone here, so the Tandy-Sharp connection also doesn't shed light on what's happening.

Interesting? Confused? So am I.

And on the subject of Sharp, rumour has it that a printer will be available "soon" for the PC-1211. Presumably, this means that Tandy will have a new release "soon".

Calculator news

Following in Sharp's footsteps, National Panasonic has announced a pocket computer, using Basic, and of similar layout to the Sharp PC-1211.

Unlike Sharp, however, it appears that Panasonic intends to launch the RL-H1000 as a system, with plug-in modules for both ROM and RAM expansion, video interface, acoustic coupler and a printer. The machine should be available this autumn in the USA, but no decision has been taken on Australian sale and no prices are available.

Another contender in the pocket computer stakes is the Nixdorf LK-3000. This machine started life as a translator under

the name of Lexicon. Nixdorf is now offering the machine with modules other than translation modules. Those which may interest readers of this column are a calculator module, a "filing system" and an "electronic notepad" or "personal program" module, comprising 1k of CMOS RAM with its own processor and operating system enabling the storage and retrieval of names files. In addition, an acoustic coupler and RS232C interface are available to allow the machine to be used as a portable terminal. The modules available, except for the "personal program", are all in ROM, and it does not appear at present that any facility exists for user written programs.

Dick Pountain

Refreshing memories

Memory chips that can refresh their own memories are just starting to appear — Celdis has announced the new Mostek 4816 chip with 2 kbytes of read and write memory — and they are so obviously useful that it seems a mystery as to why it wasn't done before. The answer is that a memory which needs refreshing can do its own refreshing — but needs to know when to do it.

Refreshing is a very simple process: it involves recharging static electricity charges in memory cells. The circuitry takes care of the problem of deciding whether there was or was not a charge in the cell to start with by reading the cell first. Unfortunately, there is a computer in most memory systems, busily reading the memory cells too. Refresh and computer reads have to be done separately, or things get very confused. The trouble is that different micros do their memory reading at different stages in the instruction cycle. A memory designer looks at the clock cycle of the processor, and arranges for refreshments when the memory is off duty. Put another processor into the system, and it will find the memory enjoying light refreshments when there's hard work to be done.

The Mostek 4816 gives the decision (when to refresh) to the system designer. But it is much easier than normal: you just tell the chip 'refresh' and it does it. In the future, the circuitry on

the memory chip that bustles around refreshing each cell, will become even brighter. Next year, Motorola promises to have a 64K bit memory chip which can study the clock cycles of the micro used and deduce from the pattern of pulses what microprocessor it is — and refresh itself accordingly.

Guy Kewney

Kiss of death

I'm really enthusiastic about the Acorn Atom. But it's bringing as much bad luck to people dealing with it in this industry as the curse of the mummy did to people in the archaeology industry.

First Cottage Computers went broke while waiting for delivery way past its publicised August release date.

Then Consolidated Marketing managed to get their hands on an Atom and displayed it at the Melbourne computer exhibition, pending the January release (was that January 1981?) Come Friday, sometime after the six o'clock closing time, and the Atom went walkabout. A little Sinclair kept it company, and although that would fit in a

pocket, how they got the Atom out the door is nobody's business. Or rather it should have been somebody's business.

Attention

I originally used that headline to vent my spleen on the Editor's misplaced sense of urgency. In line with editorial practice world wide, he's now co-opted my idea, together with another idea of mine to get "his" brilliant new plan announced.

So. APC is starting an advertising section for professional or budding programmers to flog their own software without recourse to selling their brain-children to the big companies. Instead of putting your baby into the byte slave trade you can advertise it with us, reach thousands of readers and retain control over your product.

We've published a pamphlet which will be forwarded to you if you need advice on how to go about it. (Just send an S.A.E. to the Editor). Even if it doesn't make you a millionaire overnight, it's a good excuse to register a business name, which always impresses friends.



A "real computer in Kit form", the CompuKit 101 is based on the powerful 6502 microprocessor, comes with 8K Micro-soft BASIC in ROM and is expandable to 8K RAM on board.

It plugs into a domestic TV, and for \$595 you get PC board, parts, construction manual, ROM and RAM. From Melbourne House (Aust.) Pty. Ltd. in Collingwood).

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MicroPro Design is now available to offer the Commodore microcomputer system at prices you can afford! We specialise in the design and manufacture of custom microcomputer equipment and have turned our efforts to the CBM and PET.

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You can now also use our MicroCon general purpose microcomputer as a slave to the CBM. This allows you to connect A/D, D/A convertors, digital inputs and digital outputs for industrial control, monitoring and data aquisition. Programmes for the MicroCon can be created in the CBM and loaded down the IEEE 488 bus into the MicroCon for execution.

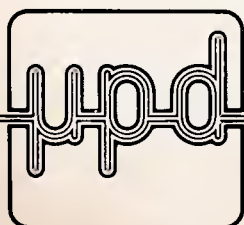
A few of the current devices now available for use with CBM and PET

IEEE 488 — RS232 INTERFACE	\$ 350.00
IEEE 488 — CENTRONICS INTERFACE	\$ 250.00
IEEE 488 — DIABLO (RICOH, QUME)	\$ 420.00
IEEE 488 — MICROCON INTERFACE	\$ 200.00
CITOH PRINTER (80 COL. 125 CPS)	\$ 970.00
DIABLO W.P. PRINTER (WITH INTERFACE)	\$3500.00

Above prices include all cables and connectors where applicable but do not include sales tax. (Dealer enquiries invited).

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Chess can be played by the Texas Instruments 99/4 home computer. The graphics are beautiful and the amazing David Levy was a major consultant in the design, so it must have something going for it. The point that will ensure that it really takes off is the four levels of playing skill. On the announcement of the chess package, it was said that the chess game plays in three styles — normal, aggressive, or passive. On the version I saw demonstrated, it also offered a fourth. It plays a strategy called "losing", at its beginner level. Irresistible, but I still didn't manage to beat it.

COBOL in miniature

MICROCOBOL is now available on National Panasonic desktop micros. It incorporates all the major facilities in mainframe ANS COBOL as well as simplifying interactive development with features such as formatted displays and structured programming. The benefits of having a business oriented language like Cobol, with its high-powered data structuring capabilities, available for use on micros is obvious.

The novice to computers is catered for with Autoclerk and Autoindex. The former allows the beginner to easily create and modify data file and generate reports. The latter is a simple to use on-line enquiry and data base management system.

Information from the Computer Company, 4 Cliff St, Milsons Point, 2061; Tel.: (02) 436 1733. There are representatives in all other state capitals.

Just cruising

Zemco has a new cruising aid for around \$88. No, Mr. Howard, I'm not trying to corrupt the morals of our youth. It's for the car and controls speeds, acceleration, gear changing and such.

It has an overtake function where the accelerator overrides cruise control, and I assume the brake will also override when you're heading for a

semitrailer.

The company claims fuel saving, less chance of accident or of being booked for speeding, no more cramped right legs or driving with the left foot on the accelerator during long trips.

Personally I'd rather a cramped leg than an atrophied brain. But as few people are as reactionary as I am, such controls are coming things; and Zemco's slogan, "There's no place for second best", together with their claim to have put some other poor beggar out of business because their product is better and cheaper, makes their product worth looking at.

Other products on the way include an ultrasonic car alarm (you can take your German Shephard off shift work), and an on-board computer.

Zemco are at 68 Alfred Street South, Milson's Point, NSW 2061; Tel: (02) 929 4033.

Neat ensemble

An American designer has come up with a new system which shows some concern for the human who will use it — by concentrating on the display technology. Mark Underwood, product development manager of a San Diego firm called Integrated Research and Information Systems (Iris, or Irisystems), had noticed the strange fact that most microsystems might be either TV screens, or black

boxes.

"The display subsystem of today's microcomputers is very important to users, yet tends to be overlooked by designers. We have tried to package a system which accommodates the different needs that users express," he says. The result is a product called Ensemble 120GX, for which most of the product announcement talks about pixels — points of light on a display screen, and normally mentioned only in describing the matrix of the dots used in generating screen characters.

The standard Ensemble is not el cheapo — but then the list of contents of what "might" be easily mistaken for a terminal" is impressive. For your \$9796, you get a Pascal Micro-engine — a powerful 16-bit processor that runs instructions written in P-code rather than clumsy machine code — plus high resolution graphics, plus a video screen, plus a 12-slot box of \$100 standard (ie cheap) cards for adding memory, special features and so on. There is a keyboard too, plus a 'big' floppy, plus 128 kbytes of memory, and an alternative Z80 processor to let you run CP/M and all the pre-written applications that come with this operating system. A cheaper version, at \$3464, offers only the Z80, one mini disk and a much smaller screen.

Underwood is proudest of the pixel count of the Ensemble: "We believe that the greatest need is for higher resolution black and white graphics. The Ensemble can present a 768 by 480 pixel format, in 8 by 16 pixel characters, some of which can be user-designed." Apparently it can handle colour too. Details on (714) 457 3730, or from 10150 Sorrento Valley Road, Suite 320, San Diego, Ca 92121.

Guy Kewney.

ROM upgrade

The 8K Basic ROM for the Sinclair ZX80 was unveiled in London in the early weeks of September. We colonial cousins shouldn't have to wait more than several weeks for it.

For under \$75.00, it will add several important capabilities to the machine. It will allow floating point, logs and trigonometrical functions, animated displays, string-handling facilities, string arrays; and the screen will stop disappearing every time you hit

the keyboard, or set the thing thinking. An overlay will be provided for the keyboard, to cope with the extra commands.

For the computer as it stands now, Melbourne House Publishers, (at 24 Peel Street, Collingwood, 3066) have made available by mail order a book called "30 Programs for the Sinclair ZX80". It includes games and educational programs and shows just what programming techniques are possible, including space compression, Peeks and Pokes and the USSR function. At around \$13.50 (including postage) it's considerably cheaper than buying programs on cassette.

Spot spotter

When a disk wears out, it doesn't do so all over its whole surface simultaneously. Instead, one or two spots flake away, causing errors. A program which keeps track of these spots and ensures that the system avoids them has been produced by Lifeboat at a US cost of \$80 for systems using the CP/M operating system. Details from New York at 1651 Third Avenue, NY NY 10028, or phone (212) 860 0300.

Guy Kewney.

Heavy duty

Compulor's new Vector Graphic System 6 Micro has been officially approved by the Western Australian Education Department for use in schools. It's a compact system designed for heavy use such as you'd get in a classroom, based on the Vector Graphic system B computer and developed by Compulor to Education Dept. specifications.

First released in the US in early 1978, the upgraded model is now available in Australia for around \$7,350. It's easily expandable from one to five independent users with their own VDU's, and each having access to the disks and 48K of RAM. It can support one or more printers, and interfaces to the Tridata Card Reader for batch processing. There are eleven high level languages available; and the system has full communication capability with other micros and time-sharing mainframes.

Information from Mr Lex Edmonds on (09) 321 5924. Compulor Australia is at Shops 11 and 17, Cloisters Arcade, 863 Hay Street, Perth, 6000.



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Facilities management consulting.

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OPAL 1000

The OPAL 1000 is an 8 slot S-100 system conforming to the new IEEE standards. A Delta Products Z80a 4 MHz CPU card, with 2 RS232c serial and 3x8 bit parallel ports, is used in conjunction with the Delta Products Disk Controller. Memory is provided by a 4MHz 64k dynamic RAM Board by Measurement Systems and Control. The memory board is fully bank selectable and is designed for upgrading to a multi-user system. Disk drives are 2x8" Shugart SA801R running at double density (480k/disk) and fitted with our exclusive Disk Saver which prolongs the life of the drives and floppy disks by turning off the AC power to the drives 14 seconds after the last drive select and thus reduces routine maintenance. The Disk Saver also reduces the risk of data loss due to power failures. The software is CP/M version 2.2 with Delta Product's utilities which include DTEST (for testing drives and floppy disks) and M2 (a comprehensive memory test program). The Delta PROM monitor enables fault finding to be carried out independently of the Disk Drives. The system is mounted in an attractive pressed Aluminium housing with a cast front panel fitted with reset button and key operated on/off switch.

Dealers for Opal in Victoria.

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SUPPLIERS FOR NDKS S-4000

MATHEMATICS

$$F(\omega) = aT \frac{\sin \omega T/2}{\omega T/2} e^{-j\omega T/2}$$

$$e_{\text{rms}}^2 = 4KTR(f_2 - f_1)$$

$$L_1 = 10 \log \frac{1}{80} \times S_n \text{ (dB)}$$

$$A^2 + B^2 = C^2$$

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Learning the game

That rather large company, IBM, is widely believed to have no part in the microprocessor market. True, in America it has set up one or two typewriter and dictating machine shops where the 5100 range of desk-top computers will be sold and software services provided, but that's hardly a threat to Radio Shack (Tandy).

Just as a snippet, I will pass on the fascinating detail that Atari Personal Computers will be distributed in America by Science Research Associates. Science Research Associates? It just happens to be an educational publisher . . . and it also just happens to be a wholly-owned subsidiary of IBM. It may lead to nothing — but it's a step in an interesting direction.

Guy Kewney

Intelligence

Don't be deceived by Intel's claim that it is changing its nature in talking about its plans for a 32-bit micro, an incredibly powerful mainframe computer on a chip.

It is true, as the company says, that normally it tries not to talk about future products, and it is also true that it is talking about a whole range of future products. What has happened to do this is not a change of attitude, but a shift of power.

My own relationship with

Intel has become a love-hate one (I love them, they hate me) because of the vulnerable position the company has forced itself into. In the market, it has been impregnable, coming out with advanced products, getting the biggest share, and leaving Texas Instruments with egg on its face not just once but several times. In its press relations, the distance Intel has been in front of the competition has made it slightly paranoid about revealing too much, with things getting to the ridiculous stage of an exclusive interview being set up in a London hotel by a top Santa Clara executive, who sat in his bedroom suite and said "no comment" exclusively for an hour.

However it remains true that companies like Intel and IBM cannot keep information truly secret merely by saying no comment. When Motorola, normally number two or three in the micro market, stole a march on Intel with the announcement of plans for the 68000 micro — the big 32-bit micro that looks like a 16-bit micro — Intel's anxious customers approached their supplier and observed that the specification looked a great deal more sophisticated than the Intel 8086. Intel was then compelled to whisper a few secrets behind its hand.

So it was that first, the "8800" was rumoured (it's the basis of Intel's 32-bit micro-system) and second, the unofficial Intel view that the

Motorola 68000 was beyond the capabilities of Motorola's technology. This latest rumour backfired. Nobody ever believed Motorola's claims about when the 68000 would be available (nobody seems to believe Intel's claims about the iAPX 432 range, either) but when Intel said that it would be, not just late, but never "because the chip is not viable" people deduced that it was beyond Intel. Intel, they said in the bars, must have tried it and failed. Hence the "break with tradition" and the willingness to talk about the iAPX (the i stands for intel) 432 and its supporting APX 186 and 286 families.

That willingness doesn't go all that deep. Most of the details released, while very interesting, are more conceptual than factual. The points Intel wants to make are not how many pins, and what voltage, and what clock speed, but first, we can build it and we will, and second, your old software will run on this. Normally, old software claims can be dismissed. There is, for instance, an Intel conversion package for re-writing 8085 code to run on the 8088. The 8088 is an 8086 (16-bit, big memory) with an 8-bit data bus — which means the user of an 8085 can get most of the power of the 8086, without throwing away his memory boards or system buses.

This package, say users who have tried it, is great for converting the sort of assembler

code generated by compilers. Run a PL/M compiler, generate 8085 code; or run a Coral compiler, generate 8085 code, and that code can be converted to 8088 with ease and no loss of efficiency. The same does not apply to human generated code because humans tend to be cleverer than compilers. They tend to take advantage of oddities of the code, and no conversion program can really hope to reproduce the function of this sort of assembler writing on the next machine because it won't be aware of what foxy assumptions the writer has made about the condition code and so on.

When one gets to the 32-bit system, the APX 432, the power available makes it largely irrelevant that conversion software may be less efficient. Intel has no intention of providing an assembler for this system — it will provide a high level language, with the chip able to run instructions at a level normally handled by the operating systems on today's 8-bit micros. So Intel strikes a big blow in the credibility stakes, keeps its anxious customers happy, and the micro market can cheerfully ignore the whole thing for another two years. By then memory will be cheap enough for us to use the 8086 and double our memory size (because of the 16-bit words) without crippling the budget. And designers at Ithaca will have produced an APX 432 board for the S100 bus, and nobody will be able to afford it.



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Tandy's new range

Radio shack (better known as Tandy in Australia) has finally released the long-awaited information on its new computer line — three new products in all. The one that will probably do the best in the market place is the TRS-80 Model III. Rumour had it that the Model III would be a colour unit, but Radio Shack has reserved a surprise on that point — it has introduced a separate colour computer as well as a very interesting hand-held unit.

The TRS-80 Model III is essentially a TRS-80 in a single cabinet, except that the disks it uses are double density and it has a built-in RS232 communications interface, which is optional on the Model I. Two 178 kbyte disk drives can be mounted in the cabinet (a configuration is available without disks) and two more drives can be added externally for a total disk capacity of 670 kbytes.

Radio Shack says that Model III Basic has many more features than Level II Basic. These include a real time clock, expanded special character set and 500 or 1500 baud cassette operation. There's also provision for keyboard-controlled screen printing and printer/video routing. Model III TRSDOS additionally allows the creation of macros and has routines to operate the communications and clock features.

A 'bare bones' version of the Model III with 4k RAM and Level I Basic is priced at \$699; a 48k Model III with two built-in disks is \$2495. It isn't difficult to predict that the TRS-80 Model III will be a real market force during the next couple of years.

At first impression, the TRS-80 Color computer appears disappointing. It's an obvious outgrowth of the TRS-80 Videotex terminal to which Radio Shack has added RAM and a Basic language which supports colour. It has a 53-key keyboard which is not nearly the same quality as those on the other TRS-80 models.

The 'Extended Color

Basic' resides in 16k of ROM, and there will apparently be 'Program Pak' ROM cartridges available for instantly loading games and other types of programs. There don't appear to be any provisions for disks or printers, but there's a cassette interface and connectors for two joysticks. The computer connects to the 300 ohm antenna terminals of a colour TV set.

The display is limited to 16 lines of 32 upper case characters, but the colour graphics resolution ranges from eight colours at 32 x 64 to one colour at 196 x 256. Some machine language programs can give a higher resolution. There's also an optional RS232 port and the unit can be used in conjunction with Videotex software for network communication.

Radio Shack's third entry is a handheld computer which runs Basic and bears a striking resemblance to a pocket computer made by Sharp in Japan which was secretly displayed at the last West Coast Computer Faire in March of this year. The TRS-80 pocket computer has a 24 character liquid crystal display and contains two 4-bit CMOS processors. One processor is dedicated to arithmetic operations while the other handles the Basic interpreter and keyboard I/O.

The operating software resides in 11k of ROM — 7k for the Basic and 4k for the

monitor. There is an additional 2k of CMOS RAM for user programs. An optional cassette interface is available for storing programs and data; this is a somewhat larger unit that the computer nestles into and requires its own battery power supply.

It will be interesting to see how these new products fare, since they have all been introduced at the same time. It's my prediction that the handheld and colour units will do poorly because they appear to be rather inconvenient, but that the Model III will take off in fine style — check back in a year and we'll see.

The Winchester

Certain breakthroughs appear to be hastening the advent of low cost Winchester disk technology in relatively small and inexpensive computer systems. Some of the factors that have inhibited the widespread use of the Winchester drives had been the problems of backup and the cost of the controller. In the past, controllers have literally been more expensive to build than the Winchester drives themselves.

This is partly because such controllers should include features found on large systems such as error checking and correction and diagnos-

tics. One solution to this dilemma has been found by Microcomputer Systems Corporation of Santa Clara. It has developed a controller module for Winchester drives that can be adapted to almost all the 8 and 5¼ inch drives now available.

The module contains a microprocessor, logic and some ROM that is adapted to the given drive. Then interface logic can be built up from readily available LSI chips to mate the controller to the drive on one side and the host computer bus on the other. Using this approach, MSC has put together a controller that will run the new 5¼ inch Shugart Technology Winchester on a Hewlett-Packard HP-85. This results in a system with close to six megabytes of disk storage for less than \$7000 and which fits on a desktop.

Other drive manufacturers are jumping on the bandwagon. Memorex and MSC have sponsored joint OEM workshops with computer manufacturers to assist them in using the MSC controller module to adapt Memorex Winchester drives to a wide range of processors and buses. This trend will no doubt result in massive hard disk systems in places where it would not have been thinkable a short time ago — even in homes!

This is by way of being a gadfly, a bubble-popper, indeed little short of a wet

Sharp's PC-1211 bears a striking resemblance to Tandy's new TRS-80 pocket computer.



blanket. There are a lot of illusions and tacit assumptions afoot about the future of microcomputers, which, while not impossible, do tend to gloss over many of the problems standing in the way of all those delirious dreams.

"...compromises have been made which turn out to be quite inefficient."

Computers are getting bigger as they grow smaller. We are now witnessing the spectacle of galloping hardware development outracing the ability of the software industry to keep up — let alone to fully utilize the enhanced capabilities of the newer processors. Not only have newer operating systems come along which try (not always successfully) to be compatible with existing applications programs but in trying to adapt existing operating system software to newer hardware, compromises have been made which turn out to be quite inefficient.

A classic example came with the introduction of hard disks to micros. Existing operating system software was not able to efficiently handle the increased capacity because the sector size was geared to floppies and required too great a percentage of disk space to keep track of directory and other housekeeping. In a couple of instances the hard disk itself was not treated as a physical entity, but was divided up into "virtual disks" that appeared to the programmer just like a large number of floppies. This may at first seem to be a

convenience from the user's point of view, but it's really just a patch and terribly wasteful of space on the hard disk.

So what are people going to do with 16-bit micros, and (saints preserve us) the 32-biters? No doubt there'll be a great many fascinating things that can be done with them, but it will be a shame if the software proves to be an impediment. The increased speed and capacity of the new machines could really bring about the level of simulation — colour, real time, complex parameters, etc. that have been in the dreams of educators but which are not yet really possible on today's 8-biters. It's well to realize that hardware alone won't do the trick.

Another popular myth, prevalent in one form in Australia and another in the States, is that access to huge data bases will instantly give us all that information we need to make our lives simpler and more productive. Yes, data bases *will contain* a great deal of information, but getting to that information and *getting* it in a form we can easily use is not a problem that's seen a lot of attention.

"...a shame if the software proves to be an impediment."

The shape and organisation of a data base tends to reflect the interests and priorities of the people who created it and not those of a broad and general public. We often walk into a library to research a problem that we've only vaguely defined in our

minds. It's only after interacting with the 'data base' and with human resources (librarians and bibliographers) that we are able to focus the direction of our search. This direction may take us on an entirely different path than we originally anticipated. The point is that in a library — a social institution — we're dealing with more than just structured information. In today's data bases, the user is left on his own to find a way through the maze, or, worse, yet, is led along a narrow path wearing blinkers which prevent him from seeing things that might aid his quest.

At the risk of sounding downright reactionary, I'll allow myself the following analogy. It's been said of microcomputers that they represent to the human mind what steam engines of the Industrial Revolution meant to human muscles. Human production did take a quantum jump as a result, but there's another side to the analogy... over-reliance on machines caused some people's muscles to go flabby. I submit that the same can be said of micros.

I'm thinking, for example, of the newer cash registers, which instead of numbers on the keys, have pictures of the sandwiches, drinks, etc. served by the establishment. Theoretically, one could train an orangutan to operate such a machine (the only impediment being the unions) but what if something goes wrong? It's here that I cease my ravings and turn to substantive items.

On the business orientated front, look for something new from Germany in the near future. A certain company there is preparing to market a machine put together out of the German Kontron system, a very

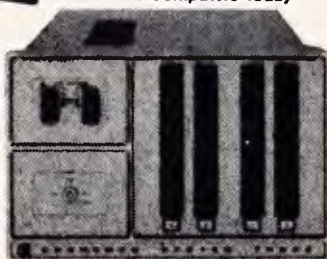
sophisticated machine with high resolution black-and-white graphics and the new 5¼" Winchester disk, drive by Shugart Technology (not to be confused with Shugart Associates, the original company). This should mark the first instance of a consumer/personal computer using the new, small Winchester.

For much more sophisticated systems, National Semiconductor has introduced a new family of 16-bit microprocessors, the NS 16000 line. One member is especially adapted to handle high level languages, and another can, in combination with a memory management chip (MMU), be used to construct a computer with virtual memory capabilities.

"...the user is left on his own to find a way through the maze."

In virtual memory, the processor generates 'virtual addresses' and the memory manager then translates these into physical addresses which can be either in RAM or on disk. The important thing is that to the programmer, all addresses appear as if they are part of one, continuous memory. It may well be said that such capabilities are beyond the abilities or needs of users of personal computers. But, bearing in mind my earlier tantrum, if proper software is developed to take advantage of the power — software that is a *superset* of existing software — then human imagination will do the rest, and we needn't worry about our brains going flabby.

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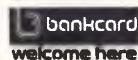
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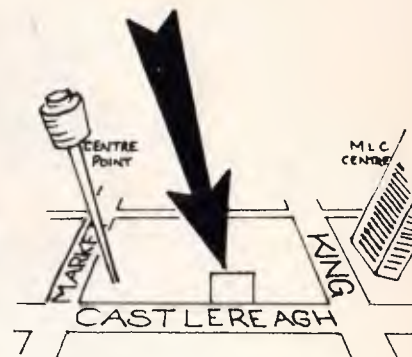
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**BENCH
TEST**

CBM 8032



Some call it the Jumbo, others refer to the SuperPET, but image-conscious Commodore has christened its 80-column PET the CBM Model 8032. It no doubt feels that PET is a bit of a silly name for a machine so clearly aimed at the business market. This month David Tebbutt puts the system through its paces and assesses its chances of success.

Commodore's long-awaited new computer comes as welcome news to all those who want a PET but feel it's not quite 'grown-up' enough for them. Mainly businessmen, they will find the 80-column screen and full keyboard overcome most of the earlier machine's limitations. Programmers used to the PET will find the new computer a bit annoying at first but they'll soon get over that.

Only one model will be offered — the 8032 with 32k of RAM of which 1k is reserved for system use; the rest is available to the user. As with PET, the Basic interpreter and the monitor are safely tucked away in ROM.

Hardware

The 8032 retains many of the features

of its illustrious predecessors. The integral 12" 'green screen' monitor is fixed to the main unit which incorporates a standard typewriter keyboard, numeric keypad and half a dozen control keys. With its metal casing it weighs in at around 50 lbs (for the benefit of younger readers, that's about 22 kilograms) and the whole unit fits adequately into the passenger seat of

Technical Data

CPU:	6502
Memory:	32k (31k user) RAM
Keyboard:	Full ASCII, numeric pad, full cursor controls
Screen:	25 lines x 80 characters, green, memory mapped
Disk Drive:	Coming soon — twin 5¼", 950k
Bus:	IEEE-488
Ports:	Cassette, memory expansion, parallel
System Software:	DOS and Monitor
Languages:	Basic

an X19 although, for the review, it seemed more at home on the dining room table.

Despite Commodore's anxiety to dissociate the 8032 from the PET, the two are very similar in appearance and performance. Games addicts will be pleased to learn that all the graphics characters can be displayed, although only 26 of them are accessible from the keyboard. 'P' is one useful character that's all but lost. While Commodore is clearly right to offer a typewriter keyboard there are many thousands of PET programmers who will find it strange that they must press the shift key to generate even common characters such as plus signs or quotes. Perhaps Commodore would like to consider a graphics keyboard option as it does with the PET. Three new keys have been added — tab, escape and repeat, and the run/stop key has been sensibly moved out of harm's way to the top right of the main keyboard. The feel of the keys is neither better nor worse than on most other machines, and they have the same tendency to emit strange 'boings' when released quickly.

The screen can display 2000 characters in 25 lines of 80 columns. The character generator in ROM contains two sets of 128 characters, each of which may be displayed as green on black or vice versa. Although Commodore isn't offering alternative character sets, it would appear that the standard chip could be replaced by a 2716 or similar EPROM. Switching between the two character sets is performed in software, either by POKEing location 59468 (as on PET) or by printing a control character.

The usable screen area is about 8½" wide by about 6½" deep and, to maintain the proportion of text, there is a blank strip between each line of the display while in text mode. Although graphics characters may be displayed while the screen is configured for text, they appear strangely disjointed so Commodore has incorporated a special 'graphics' display mode. The key sequence print-quote-escape-reverse-shift-N-return (don't worry, you'll soon get the hang of it) removes the interleaving blank strips from the display which then reduces in height to a little over 5". The characters don't alter in size and text is quite readable, albeit a little cramped.

Programs and data may be stored either on cassette or disk though neither unit is supplied with the machine. Commodore sells a cassette unit without sound or tape counter for \$126 and the 3040 floppy disk unit, costing \$2305, provides 343k of user storage. Only one unit can be connected, so it is good news that a new dual drive (the 8050 offering 950k) is now available at \$3100. A 3040 disk unit was loaned for the review and

any comments will relate to this model.

The innards of the 8032 appear little different to those of its more recent predecessors, though the layout of the main board has been turned through 90 degrees so that the RAM chips now run alongside the heatsink. A larger Basic and operating system mean that only two sockets are left for ROM/PROM expansion — the addresses from B000H to BFFFH have already been taken. Given that the 8000 series is meant for serious users, it's not surprising that Commodore has failed to publicise the built-in soundbox. Come to think of it they might have trouble with the Trades Description Act if they did. Its only built-in function is a 'bell' that chirps five characters before the end of each line with a sound reminiscent of chalk on a shiny blackboard. The bell effect is achieved by playing a jolly jingle, the speed of which can be varied from 0 to 2¼ seconds by POKEing 231 with a value from 0 to 255 — Commodore uses 16. Prospective buyers are strongly recommended to try 'POKE 231,0' when the salesman's back is turned.

Connections to the outside world are exactly the same as on the PET: an IEEE-488 interface, a parallel user port, a cassette interface and a memory expansion port. The most useful of these is the IEEE-488 edge connector to which Commodore printers and disks may be attached as well as the more usual scientific and laboratory equipment. Other makes of peripheral may require a special interface between them and the 8032.

Software

The 8032 comes with Basic 4.0 in ROM. Existing PET owners will be pleased to learn that the garbage collection problem is responding to treatment, though it has unpleasant side effects — more about that later. The other major change is that 15 disk commands have been added, representing a vast improvement on the previous disk handling procedures.

One of the 8000 series brochures refers to 24k of ROM. The review machine was presumably still growing, because we could find only 18k, of which 1k was unused. If Commodore expands its Basic it should consider adding commands such as LINE INPUT, INSTRING and MERGE, which are very noticeable by their absence.

An interesting feature of the CBM range is that only the most rudimentary disk handling is carried out by the main processor. Most of the work is carried out by another 6502 housed in the disk unit, and therefore many functions take up very little of the 8032's processor time. The disk unit tested was fitted with DOS 2.1 ROMs which are free from most of the bugs which plagued

earlier versions. However, the use of DLOAD to chain from one program to a larger one results in the second program being corrupted and this could prove a slight problem for those writing large systems. Although CBM's relative (ie random) file handling is somewhat esoteric, after a few hours we felt quite at home with the commands.

Data storage efficiency is somewhat erratic, ranging from the sublime, in which records are allowed to cross physical sector boundaries, to the ridiculous, where numbers stored on disk take up one byte per digit plus one for the decimal point, if any. (In RAM, integers are stored in two bytes while five are used for floating-point numbers. Unfortunately, there is no easy way of writing data to disk in this form.) There are two basic methods of inputting data from a disk record: GET# which fetches one character and INPUT# which reads until it reaches a carriage return — more than 80 characters in a field will give a 'STRING TOO LONG'

The good news for machine code freaks is that the 'TIM' monitor is unchanged; the bad news is that the second cassette buffer is no longer freely available. It appears that 40 bytes at the bottom are used by the disk commands, and 20 bytes just below the start of Basic are used for tabs and other, unidentified, purposes. Up to 80 horizontal tabs may be set by pressing shift-tab, but the same key combination is also used to clear them, so you must be careful. Unfortunately tabs do not affect a printer and pressing the tab key when past the last tab stop takes you to the end of that line, not to the first tab position on the next.

The most exciting new function must be the auto repeat on the cursor movement, INS/DEL and SPACE keys. All other keys will repeat when pressed in conjunction with the REPEAT key. Other screen handling functions allow you to insert or delete a line at the current cursor position, erase the current line up to or from the cursor and even scroll the screen up or down irrespective of the cursor position. Text editing is an obvious application for these new features, but no doubt programmers up and down the country will be frantically searching for others.

The facility that sets the 8032 apart from many other micros is its ability to restrict scrolling and all other screen functions to a rectangular 'window', the size and position of which is set by the user. Four locations in page zero are used to define it, and it's probably simpler to POKE these locations rather than move the cursor to the corners of the window and print the appropriate control characters. The window can be dismantled by pressing the HOME key twice in succession — something the programmer will have to trap. For some reason (a bug?) tabs included in the Basic statements are calculated not from the left margin of the window, but from the left of the full screen.

Even more mysterious is the 'STRING TOO LONG' error which appears only when the left margin of the window is set greater than 10, and the RETURN key is hit immediately after the CLEAR key.

The only criticism of the screen functions is that they're not readily available from the keyboard — they're generated by printing an appropriate reverse field

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character within quotes. However, because there is no key on the keyboard that will generate these characters directly, you must press the escape key (taking you out of the mode in which control characters are normally displayed), then REVERSE, then the appropriate letter — which may be shifted. No doubt it will seem very natural after a few years, but it would be so much easier if Commodore had provided a control key.

Returning now to the subject of garbage collection — one characteristic of Microsoft Basic is its dynamic storage of strings. Each time a string variable is redefined it's rewritten elsewhere in memory, the previous representation becoming redundant. When the memory available for strings is exhausted, program execution halts while a 'garbage collection' routine disposes of the redundant strings and gathers together those that are still valid. At worst garbage collection now takes less than a second, against 20 minutes (in an extreme case) with earlier PET Basics. A slight disadvantage is that each string variable now takes up two additional bytes which are used for a vector pointing from the string storage area to the variable table. Each element in a string array now uses five bytes in addition to the length of the string, and for string variables the overhead is nine bytes. Another disadvantage is that creating a new non-array variable now takes up to half a second because the whole of the array table must be moved up — the secret is to mention each variable before setting up the arrays. String operations seem to be slightly faster overall by about 10%. However Benchmark timings, which don't test string handling, give identical timings to those for the new ROM PET.

Potential use

The CBM 8032 is a convenient computer, easily transportable and sturdy, the only essential add-on being the cassette deck or the disk drive. The Basic includes all the common mathematical functions and, while not as comprehensive as most disk Basics it is faster than average. The 80-column screen is ideal for business use and, though the 8032 may be more difficult to program than many machines, this will not affect the vast majority of business users as there are sure to be plenty of packages available.

Whether this new model will be bought for use in schools, colleges and the home is more questionable. The screen handling functions are impressive, but hard to use, and most of the graphics characters are inaccessible

from the keyboard. The recommended price is \$600 more than that of the 32k PET and more than twice that of an 8k machine with a built-in cassette. Commodore has aimed the 8000 series at the business market and it looks to have a good chance of achieving its objective. Because the 8032 is this year's model, a particular sector of the personal market will rush to buy but, at present prices, the existing range should have plenty of mileage left in it yet.

Compatibility

If you are thinking of upgrading from your existing PET, it won't be too difficult to modify existing software. Most of page zero is virtually unchanged and, while routines in ROM have been shuffled around, the majority perform exactly the same functions. Games programmers should note that the values stored in locations 151 and 166 have changed — they are no longer keyboard values, but garbled ASCII.

The 'window' facility makes it easy to simulate a 40-column screen, although programs that poke the screen will need changes as it now occupies RAM addresses 32768 to 34767.

Machine code programs that call Basic routines or use the second cassette buffer will need rewriting but most others will run without modification. The 'merge' technique can still be used to load subroutines or utility programs, although it founders if a line which lists more than 80 characters (including line number) is included.

To summarise, conversion of new ROM programs for the 8032 will be fairly easy, in many cases easier than converting between old and new ROM PETs.

Documentation

Two manuals were supplied with the review machine — a Users' Guide and a preliminary Basic/DOS manual. The users' guide is a good introduction to the mysteries of computer operation; as well as covering the physical controls, it describes all the command functions necessary for successful machine operation.

The preliminary manual was exactly that. Essentially written for Commodore dealers, it assumes a fair degree of prior knowledge. We hope that the version supplied to users of the 8032 is more comprehensive, though in this respect Commodore's track record is not enviable. Even this dealer's manual leaves out such useful information as the fact that auto-repeat can be disabled and that the length of the keyboard

buffer can be altered. A good start, but serious programmers will need more, much more.

Conclusions

Commodore set out to widen its influence on the business market and without doubt it will succeed with the model 8032 which looks, feels and behaves like a business computer. Programmers used to the PET will find the 8032 an irritating machine to work with but no doubt they'll learn to love it. Let's face it — they'll have to.

The gaps in the memory map give hints of greater things to come — we hope it's not too long before Commodore extends the system software to make up for the odd weaknesses in the present version.

Finally, whether or not you're a businessman, if you require a display of more than 40 columns then you must put the 8032 on your shortlist of possible machines.

Memory map

FFFF	Basic + OS
B000	ROM expansion
9000	Unused
8800	Screen RAM
8000	User RAM
0400	
0000	Basic RAM

Benchmark timings (in seconds)

BM1	1.7
BM2	10.0
BM3	18.4
BM4	20.3
BM5	21.9
BM6	32.4
BM7	51.0
BM8	11.9

At a glance

FIRST IMPRESSIONS

Looks	****
Setting up	*****
Ease of use	*****

HIGH LEVEL LANGUAGES

Basic	***
Pascal	***

PACKAGES Being planned

PERFORMANCE

Processor	***
Cassette	****
Disk	***

EXPANSION

Memory	*
Cassettes	****
Disk	*
Bus	****

COMPATABILITY

Hardware	*
Software	**

DOCUMENTATION

--	-----

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****	v. good
***	good
**	fair
*	poor

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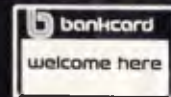
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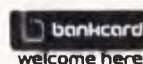
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MICROCHESS

Our resident micro chess expert Kevin O'Connell reports on an interesting chess contest with a difference — it's one that's being fought out in the law courts.

WHO'S KING?

The strongest chess playing program currently on the market is that produced by the husband and wife team of Dan and Kathe Spracklen. The program is 'Sargon 2.5' or, alternatively, 'Boris 2.5'; they're identical except that Sargon is manufactured by Applied Concepts Inc. of Texas and marketed by Chafitz Inc. of Maryland, while Boris is both manufactured and marketed by Applied Concepts. A little disagreement between the two companies has given rise to the two names and at least one lawsuit that's reputed to involve around 12 megabucks.

Applied Concepts, who have registered 'Boris' as their trademark, use the advertising slogan 'Boris is King', while 'Sargon', for those of you who have forgotten more Assyrian and Babylonian than you ever learned, means 'Declared King'. The direct line of descent, incidentally, is: Sargon I (ca 3000 BC), Sargon II (722-705 BC) and Sargon 2.5 (1979 -). One more juicy palace intrigue before looking at the program: the Spracklens were made a rather tempting offer by Fidelity Electronics (manufacturers of the Chess Challenger range) to commit infanticide and join the forces of the vociferous young pretender to the throne.

Boris 2.5/Sargon 2.5 usually comes in the form of a module for the Applied Concepts/Chafitz Modular Game System. Before I go any further along this treacherous path I propose to adopt the following terminology: Sargon for the program and Applied Concepts for the manufacturer/marketer.

The concept of a modular system is basically a good one. The idea is that when the program is improved, you can simply buy a new module rather than a whole new machine. However, it's somewhat doubtful whether any significant increase in playing strength can be effected with 8k of ROM and 1k of RAM. If you increase the amount of RAM you can certainly achieve more. The trouble with that, though, is that you may be left in the somewhat unhappy position of keeping the 8k ROM module and buying a new system to plug it into! Nevertheless Mr. Terry Knight has the novel idea of an 8K module to play the opening, then another to handle the middlegame and, finally, almost 8k of look-up tables to play a formidable endgame.

Sargon is one of the very few machines to have established a significant track record in competitions. Way back in March 1978 an early version won the first ever microcomputer chess tournament in San Jose, California, with a clean score, finishing ahead of the Commodore Chessmate, Boris and Chess Challenger — all of whom tied for second place. In the 1978 North

American Computer Championship Sargon II finished third behind two monsters: Belle and Chess 4.7. Last year the upgraded version, Sargon 3, won the Personal Computer World tournament in England with a clean score and placed 7th equal in the North American Computer Championship. That same year it also played in a tournament that was basically for humans in the Paul Masson vineyards in California. The program, unaffected by the vinous surroundings, made a plus score and achieved an official rating of 1641 (playing on its level 4).

There is a worldwide rating system for chess players: Here are a few figures to help put Sargon in perspective. The reigning world championships are: Anatoly Karpov (human) 2725, Maya Chiburdanidze (human, female) 2400, Yasser Seirawan (human, junior) 2510, Chess 4.6 (Computer) 2100. A rating of 2200 indicates master level. Sargon currently rates about the same as a moderately good club player.

Sargon has seven levels of play, five of which have a reasonable average response time: level 0 (instant response), level 1 (10 seconds), level 2 (20 seconds), level 3 (45 seconds), level 4 (2 minutes). In play it can seem to respond even more quickly because the program, having played its move continues to analyse a tree based on what it considers to be the most likely reply by the opponent.

Sargon's playing strength vis-a-vis the other good chess machines on the market can be judged from its 10-7 victory over Chess Champion System III which in turn defeated the Voice Challenger by 10-7. If you are one of the very few thousand serious chess players in this country, playing regularly in club and tournament competition, then at the moment Sargon may be the only program to offer you stiff enough opposition.

The basic operation of Sargon is easy enough in its game playing mode and setting up a position is also quite straightforward. There is a 'restore' key which enables you to take back up to six ply (three moves for each side), two ply at a time, but you can never restore back to the original position. Thus, if you are anxious to play a particular opening, you have to run through the laborious process of switching the machine off and on, each time waiting while 'Sargon awaits your move' scrolls across the display and hoping all the while to achieve the opening of your choice.

There is one thing about Sargon 2.5 which I hate — the 60-odd (or 60 odd) messages which appear on the display from time to time. They range from the sublime ('woops') to the ridiculous ('are there ladies present?'). Apparently

customers are about equally divided in liking or disliking them. However, it seems to me to be simply a waste of about 1k of ROM and an unforgivable mistake on the designer's part that you cannot exclude them, even if you want to.

As an alternative to the Sargon 2.5, you can get a slightly weaker version of the program, for about \$19, in the form of *Sargon, A Computer Chess Program* by Dan and Kathe Spracklen, published by Hayden (Australian distributor — Butterworth). Of course, for this version you will need a few other things: some time, a steady typing speed and a system that uses Z80 assembler, (minimum 8k RAM). Preferably your Reset button will be safely mounted at the back of your system, if not then allow lots of time for keying in!

There is also a more expensive ready-made version, with an 'auto response board'. If money means nothing to you, then take a look at it; the craftsmanship of the inlaid wooden board is superb. This version has another great asset: since it has no display (moves are indicated by LEDs inset into the 64 squares) the comments have been excluded and replaced, I am told, by extra openings.

First Computer World Chess champion

No, it has not happened yet, but the Fredkin Foundation of Cambridge Massachusetts, recently offered a \$100,000 prize for the first computer program to win the world chess championship.

While programmers continue to strive for world-class chess skill in their programs, the Fredkin Foundation is offering a series of incentive prizes for computer-against human competition. Two human players of a specified skill level will be selected each year to play the two top programs. Each will play a two-game match, winner take all. The first competition will take place this November at Carnegie-Mellon University; the prizes will be \$1500 and \$1000. In each succeeding year, stronger humans will be selected and the prizes will be increased.

When asked what players should do, in general, to improve their play, the world champion, Anatoly Karpov, replied, "Endgames, study endgames". That is good advice for chess programmers too, but my advice to Karpov is — computers, study computers!

BASIC BASIC

The problem with Basic is that there are so many mutually incompatible versions around that transferring a program from one machine to another can often be quite difficult. Mike Parr suggests a way of presenting programs so that they can be easily implemented by users of any machine.

Welcome to the world of 'Microsoft' Basic! On flicking through the pages of APC you've probably seen many systems which claim to run a version of Microsoft Basic — e.g. Tandy Level II, PET, CP-4P, and Sorcerer. You could be forgiven for thinking that programs are easily transferred between these machines. The fact is though that a considerable amount of rewriting may be required. For example:

```
10 IF A=B THEN X=INSTR(L$, "A")
ELSE GOTO 50
```

will happily run on a Tandy but not, for example, on a PET. The latter machine cannot handle either the ELSE or the INSTR functions.

Bearing in mind that an APC program might be typed in and edited by people as diverse as typists, businessmen or teachers then the problem of compatibility is a major one. There have been various approaches aimed at facilitating program 'portability', including the use of a 'universal' assembler-type language, which is easy to adapt for any machine, and even rigorous high-level language definition, such as Algol 68. It would be nice to say that Pascal allows machine-independent software but, even here, it seems that dialects are going to differ. Already we see Transam and USCD compilers being based on different standards.

However, all is not lost — the different versions of Microsoft Basic are sufficiently similar to enable you, with a bit of care, to write programs that run on any system with little or no modification.

There are four main areas where portability problems occur — statements, data types, functions and input/output. I shall now examine each of these in turn.

Statements

The following statements occur in almost all Microsoft implementations: GOTO, IF . . . THEN, END, STOP, LET (or just plain =), FOR . . . TO . . . STEP, NEXT, DEF FN (numeric only), DIM, REM, GOSUB, RETURN, PRINT, INPUT, READ, DATA, RESTORE, CLEAR, ON . . . GOTO, ON . . . GOSUB and, finally, a colon may be used to separate statements.

It's clear that you can achieve maximum program portability by restricting your published programs to the above Microsoft subset. It will, of course, mean that some of your routines may not be as elegant as you might like but then again it does ensure that your efforts reach as wide an audience as possible.

Before moving on to data types I shall illustrate a few of the more common Basic functions which I have had to leave out of the subset:

```
10 IF A=B THEN PRINT C ELSE STOP
20 IF C=D, PRINT E
LINEINPUT, which reads a complete line of text, including spaces, commas and quotes into a single string variable. Believe it or not, this too is absent from many systems.
```

File OPEN and CLOSE is missing as well, because some systems don't have data files, and PEEK, POKE and

USR are definitely out of the question as they are the very essence of machine dependency. Finally, CLEAR is similar on most machines but not identical, so it must also be banned.

Apart from the statements themselves there's the question of line lengths. Tandy for example is 64 characters, while Superboard is 71 (yes, 71!) and PET is 80.

The moral is clear . . . when it comes to statements keep the lines short and work as far as possible within the subset.

Data types

The second aspect of portability concerns data types. Microsoft Basic includes floating point numbers, strings of up to 255 characters, arrays of either type with no limit on the number of elements or dimensions and where only the first two letters of a variable name are significant.

On some systems, other variable types are allowed. An integer, for example, is sometimes defined by following its name with a % character thus: 20 I%=I%-1

Tandy has a more powerful system, including a set of statements like DEFINT I-N, which automatically causes all variables starting with the letters I to N to be treated as integers. In many programs, leaving out any special integer use has no serious effect (unless memory happens to be very tight). Finally, I should mention accuracy. Most hobbyist programs don't rely on high numerical accuracy, which is just as well since many systems have only 6 or 7 digits of precision. In general I would suggest that you stick to single precision floating point numbers unless memory size and arithmetic precision are particularly important to your application.

Input/Output

The remaining (and most involved) area deals with data-file I/O and memory-mapped graphics. The suggested approach is to use subroutines for primitive functions, commented in such a way that the average user (given reasonable system documentation) can amend them to fit any computer. As an example, consider memory-mapped graphics, instead of just writing:

```
10 POKE 16300+Y*40+X, 65
```

you could write:

```
10 C=65 : GOSUB 2000
```

then:

```
2000 REM PLOT CHAR C AT X, Y;  
(0,0 IS TOP LEFT)
```

```
2010 POKE 16300+Y*40+X,C
```

```
2030 RETURN
```

. . . with the result that the user only needs to alter the subroutine, not dozens of POKES throughout the program. Ideally you would also incorporate checks on the ranges of X and Y, as screen sizes vary between machines.

Looking now at file I/O, PET and Tandy users may be amazed to learn that many systems have no provision for cassette data files, other than resorting to PEEK, POKE and USR facilities. On most disk systems however, typical statements are:

```
ASC, CHR$, LEFT$, LEN, MID$,  
RIGHT$, STR$, VAL.
```

The main omission here is the useful

INSTR string searching function, which is missing from many systems. For complete compatibility, one can use a subroutine which performs a similar function (albeit slower) but, if you must use it, avoid the nested form:

```
10 AS=LEFT$(L$, INSTR(L$, "A"))
as the PET user may be replacing
INSTR by GOSUB, and would prefer:
10 P=INSTR(L$, "A")
20 AS=LEFT$(L$, P)
this being much easier to edit.
```

Finally, most systems include the FRE function, used with either a numeric or string argument. This is fine, but bear in mind that, as with CLEAR, certain assumptions about free space may be machine-dependent (for example, one might use FRE to determine the maximum subscript for a numeric array — however, don't assume that all systems use the same number of bytes to store each array element).

Standard Functions

All Microsoft systems have these numeric functions:

ABS, ATN, COS, EXP, INT, LOG, RND, SGN, SIN, SQR, TAN, TAB.

They also have the logical functions (actually operators) of AND, OR and NOT which treat their operands as 16-bit two's complement integers. The 16-bit number, consisting of all ones, is regarded as logical TRUE, (its value being -1).

The only major difference between the built-in functions concerns RND. Most machines will produce a value between 0 and 1 whereas Tandy, for example, will give a value between 1 and n. To make such a program more portable, you should only assume the presence of random numbers from 0 to 1, and modify the result using a scale factor and the INT function.

Character functions include:
OPEN, CLOSE, PRINT 1, INPUT 1, LINEINPUT 1

... together with the EOF(N) function, which returns a 'true' value if there is no more information in file number N. As an example, one could list a file on the VDU by:

```
10 REM OPEN FILE CALLED HIM
FOR INPUT AS UNIT 1
20 OPEN "JIM", I, 1
30 IF EOF (1) THEN CLOSE 1: END
40 LINEINPUT 1, L$:PRINT L$:
GOTO 30
```

In fact, very few cassette systems could handle this (reasonable) program. PET and Tandy machines, for example, have no LINEINPUT and the Sorcerer can't even read text from tape, as data is only allowed to be in the form of numeric arrays.

A further problem exists concerning motor control. Examining cassette handling on 'good' systems such as PET and Tandy, one sees that the task of tape I/O consists of:

Output	Input
Start motor	Start motor
Wait (and transmit 'null' chars.)	Ignore 'null' characters.
Transmit line.	Read line.
Stop Motor.	Stop motor.

On a machine with no cassette motor control, problems will arise when trying to run this type of program:
1. Read data from tape.
2. Process data.

3. Goto step 1.

If step 2 involves lengthy calculations, the cassette (which is still running) may be in the middle of the next data line before the program is ready to read from it. Once again, the approach to take is to write all machine-dependent software in commented subroutines, which provide the primitive operations of reading and writing complete lines of text. Output is straightforward, except for the proviso that, if no motor control exists, sufficient 'null' characters must be used to enable the program that will eventually use the data to "keep up":
4000 REM. L\$ TO FILE
4010 PRINT 1, L\$
4020 RETURN

The Superboard user, for example, may replace this by a routine to transmit 'null' characters for a second or two, then to transmit L\$ character by character.

The file input routine is the equivalent of:

```
5000 REM. READ LINE TO L$
5010 LINEINPUT 1, L$
5020 RETURN
```

... where the Tandy user may replace 5010 by a loop using INSTR\$ to build up L\$, and Sorcerer users might use CLOAD, converting the input numeric array to a character string in L\$. Obviously, the input and output routines should be compatible in the sense that strings transmitted to and read back from file should appear identical.

Additionally, one requires an end-of-file test, and an easy machine-dependent solution is to denote the end with a special peculiar line such as "+/+". If this is adopted, the EOF () function is not required, and the 'higher-level' input routine becomes:

```
6000 REM LINE TO L$. SET EF TO
-1 ON EOF
6010 EF=0: GOSUB 5000
6020 IF L$="+/+" THEN EF= -1
6030 RETURN
```

To complete the I/O routines, we require open and close facilities for our files:

```
7000 REM. OPEN OUTPUT FILE
7010 PRINT "PRESS RECORD AND
PLAY, THEN ENTER ANY CHARACTER": INPUT L$
7020 RETURN
8000 RETURN
8000 REM. OPEN INPUT FILE
8010 PRINT "PRESS PLAY, THEN
ENTER ANY CHARACTER": INPUT L$
8020 RETURN
```

(if you have an 'open' statement, insert it at 7005 and 8005)

```
9000 REM. CLOSE INPUT FILE
9010 RETURN
```

```
CLOSE may be inserted at 9005)
1000 REM. CLOSE OUTPUT FILE
10010 L$="+/+" : GOSUB 4000
10020 RETURN
```

(Again, if you have a CLOSE, place it at 10015)

These routines assume no named files — though modification would be trivial if you have such luxuries — and one file device only (a cassette deck perhaps). In common with the 'subset' approach, only the minimum facilities are assumed.

To summarise I/O, the benefits of this method appear when you attempt to transfer programs between machines

with widely differing I/O methods. Finally, if you think that these routines preclude numeric I/O, it's no trouble to use the built-in conversion functions, so instead of:

```
10 PRINT 1, N
```

you may write:

```
10 L$=VAL$(N): GOSUB 4000
```

Conclusions

With a little forethought and a bit more typing, portable software is possible. It must be admitted that some defy portability — some flashy graphics could give problems, and memory size may be significant in large programs. However, there's no reason why the remainder should not see much wider use once a Microsoft subset has been followed.

Example

To illustrate what I mean here's a useful example that conforms as near as possible to the 'rules' that I've proposed. The program is an interactive data-file editor for any single-cassette system, illustrating the use of a subset, and the file I/O routines. The data lines are read into a large text array T\$(), and may then be edited by the following commands, typed in response to "C?". Back — by a specified number of lines. Forwards — by a specified number of lines.

List — as Forwards, but display lines. Delete — delete current line, and move to next one.

Insert — insert a new line after the current one.

Replace — replace the current line by a new line.

SAVE — save the edited text on cassette.

Search — search for a line containing a specified string.

Top — move back to 'top' of file.

(Only the initial, capital letters of the command should be used.) The commands relate to the current line, usually the last line displayed. e.g. to move forward 3 lines:

F is typed in response to C?

FOR? is printed by the program.

3 is entered by user.

To actually use the program, load it from its own cassette, then place the data tape in the recorder, ensuring that it is rewound. Type "Y" in response to the 'existing file' question, and perform the edits. Before typing SAVE, either rewind the data tape, or load a fresh one (thus giving you a back-up copy). To create a new file, type "N" instead of "Y".

The program occupies around 2200 bytes thus leaving, in an 8k system, some 6000 bytes for text (about 200 lines of 30 characters). On your system, alter line 20 to clear your maximum string space, estimate your average line length, and dimension T\$() to the maximum possible number of lines.

If your data doesn't have commas or leading spaces, INPUT 1 can be used in place of LINEINPUT 1. For those with no cassette motor control, only a very short delay is needed in routine 8000, as the lines are rapidly read and stored in T\$(). In fact, the cassette control on the Tandy, involving a delay of several seconds, is a disadvantage in this type of input.

GOTO page 56 for Listing

PERSONAL OPINION

by Bob Pacsoe.

R.S.V. Pacsoe is a lecturer in Computer Science at the Royal Melbourne Institute of Technology, where he lectures on Compiler Design & Programming Methodology. He is also an industrial consultant on programming languages and an active programmer.

Many if not most, of the readers of APC are likely to be fairly good programmers in one language — Basic. Well that's unfortunate! The era of the new languages, such as Pascal, is with us. And, like it or not, if your only expertise is Basic, then you may as well forget computing and take up mushroom farming. The new breed of whiz kids, with their data structures, recursion and structured code, are going to walk all over you".

Still reading? Good! A little hot under the collar? Excellent! What a way to start a column — by insulting most readers so that they "switch-off" and don't read any more. Thanks for staying this far!

What I would like to talk about here is this well known hot-head reaction of programmers to 'new languages' — whether Basic versus the 'new' Pascal, or Pascal versus the new ADA, or whatever. Why do we all get so defensive?

To answer this, we must look at what motivates people to write computer programs. Some people, the professional and the entrepreneur hobbyist, are in it for money, or, at least, for the promise of money. Some

people program computers because they really do need to use them to assist in their business or research.

But it seems to me that these motivations are really only peripheral to the underlying psychology of programming. In a fairly long history of working as a programmer and with other programmers, I have never yet failed to study the way a programmer reacts to his finished product. And it's always the same. Some manifestation of pride — some interpretation which says 'look I've done it — I've thought and thought, I've battled, and I've produced a working creation of pure logic'.

Many times I've watched people who have just completed long programming projects — some go to the Pub and get drunk, some make themselves unpopular by relating endless details of their creation to everyone in sight, and some just smile quietly to themselves and go about their business. But they all feel the same.

Some — the more experienced and more mature programmers; the sort of person I dearly love to have on a programming team — mix an element of remorse with their end of job pride. They know that all large programs are compromises, that given the job over again they could have done it more elegantly. They come out of their job as better human beings, more able and more determined to put a little extra thought into their next job. These people are often the 'super programmers' of the industry. They lie at the opposite end of the spectrum to the so-called 'Gee Whiz' programmer.

Well for the moment let's acknowledge the existence of the 'pride factor', and see why people are so defensive about their programming style, and their programming language.

It all comes back on where we hang our hats — that is, being able to explain exactly what our expertise is.

A great racing car driver rides his car through a turn like his ancestors rode their horses. A superb skier goes down a difficult slope with his skis 'glued together'. But what of we humble programmers? Can we dare say we are experts in problem solving? We could and we should — but we usually don't. Instead, we try to find something more concrete. And the language we use usually ends up as the scapegoat. We are experts in Basic or Fortran or assembler. What a lot of rot! We are experts in problem solving, and the language is our tool.

Let's say Basic is our claimed area of expertise. When we talk Basic we feel comfortable, at ease, secure. But when someone mentions Pascal we enter unfamiliar territory, we feel insecure. And we will probably react, naturally but unfortunately, by brushing the intruder aside. It is a natural defense mechanism which protects our pride. All this would disappear if we saw languages in their proper perspective as tools. A new language should be no more threat to us than a new style of disk unit! The problem is far worse in industry of course where programming managers may see their 'domination' of their staff as coming from their expertise in an old language. Huge computer users

have been frozen in their techniques by attitudes such as this. The costs are enormous.

Of course, some tools are better than others. I, for one, firmly believe that Pascal and its sister languages are far stronger and more reliable tools to aid us in the production of programs than, say, Basic. But Basic, by virtue of the open availability of compilers and Basic programs generally, is still the major choice of the personal computer fraternity. And this choice is not necessarily an invalid one, although I believe that Pascal will eventually replace Basic as it becomes more readily available, and user expertise grows.

Incidentally, from the Computer Science Viewpoint (the theory of machines; the world of Turing Machines and Pushdown Automata) all languages which possess the rudiments of at least an IF statement and a GOTO statement are equally powerful. That is, a problem which is 'computable' in one language is also 'computable' in any other. But the amount of effort required to produce a solution, as well as the reliability of that solution, will certainly vary with the language used. What is a "reliable" program? What is a "good" program? That I would like to consider in two months' time.

Next month I will look at high level languages and their implementation requirements. In particular, the new breed of 16-bit fellows, such as Zilog's Z8000, and the Motorola 68000 seems to be designed to support high level languages. What's it all about? and when will they be available to the hobbyist? — in next month's issue.

MS Microsoftware

TAPE 2 LEVEL 2

Investment, future value regular deposits; regular withdrawals, initial minimum (for withdrawals); nominal interest, effective & earned-interest; depreciation rate, amount depreciation; salvage value; discount commercial paper; loan principal, regular and last payment, remaining balance, term-loan; mortgage amortization; greatest common denom. - integer prime factors; polygon area; triangle parts; analysis, operations two vectors; radian-degree, degree-radian conversion; co-ordinate, polar equation, functions plot; linear, curvilinear interpolation; Simpson's & trapezoidal rules, Gaussian quadrature integration; derivative.

Side 2 — quadratic equation, polynomial (Newton) & half interval-search roots; trig. polynomial; simultaneous equations; linear programming; matrix addition, subtraction; scalar multiplication, inversion; permutations & combinations; Mann-Whitney U test; mean, variance, standard deviation; geometric mean & deviation; binomial, Poisson normal, Chi-square distribution; Chi-sq., student's T distribution test; F-distribution; linear correlation coefficient; linear, multiple-linear, Nth order, geometric, exponential regression; system reliability; future projections; Federal withholding taxes: tax depreciation schedule: check writer; recipe cost; map check; day of week; days between two dates; anglo to metric; alphabetize.

TAPE 5 LEVEL 2

Memory test, mortgage payments, tension breaker, lineprinter-screen & vice-versa utilities, Federal income tax, election returns, business percentage, vacation planner, car pool (disk), diet planning 2, mailing list (disk) and first aid.

Also spelling bee, Star Trek 3, mind bender, tachistoscope, chase, common factor, klingon capture, spelling practice, Hamurabi, animals, Snoopy, cryptogram, starship, ants, Yesterday, and Pilot (disk). Pilot is the language of computer-aided instruction (CAI).

TAPE 7 LEVEL 2

Disassembler, Pilot, roster, dropout, memory loader, memory sort, inventory control, graph, land surveying, mixed monthly sales report, shopping list, diet planning 3, loan progress chart, hex-decimal conversion.

Also Star Trek 4, states and capitals, battleships 2, spelling practice 2, number guessing, hangman 2, snark, slot machine, cipher, target, surround, adder, termites, lunar lander, multiplication exercise, five-in-a-row, Bastem, and write. A number after a program indicates there are other similar People's Software programs. Pilot is the same as the disk pilot on tape 5, except runs on 16K tape systems.

Each Tape \$9.90 (incl. postage within Australia)
Please mail your order to:

**MS Microsoftware,
P.O. Box 119, Essendon, Victoria, 3040.**

SAVE US!

APC's reply to the recent wave of DIY Atomic Bomb articles (courtesy of Consolidated Marketing Corporation): extracts from a patent recently taken out in Great Britain.

(71) I, ARTHUR PAUL PEDRICK, British subject, of 77, Hillfield Road, Selsey, Sussex, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention is concerned with creating underground shelters for protection against an attack by *H* bomb carrying inter-continental-ballistic-missiles.

In the accompanying drawings . . .

Figures 1 to 4 show various stages in the construction of an underground shelter against bombardment by *H* bomb carrying ICBM missiles, by exploding underground, a bomb, and Figure 3 shows the form of the *H* Bomb shelter as a completed structure.

Figures 1 to 3 show the successive stages by which an *H* Bomb shelter may be created by exploding a bomb underground.

As in figure 1, the bomb, given a sharply coned base, is driven down into the ground at the base of tube *T* of steel of substantial thickness by pile driving in well known manner.

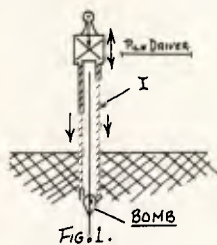


Figure 2 shows how, when the bomb is detonated, the shock of the explosion goes mainly down and around the outside of the tube *T* to create a crater, but part of the shock waves are used to drive material out of the tube *T*.

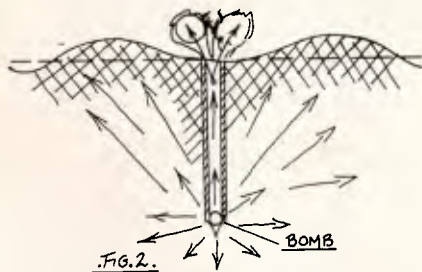
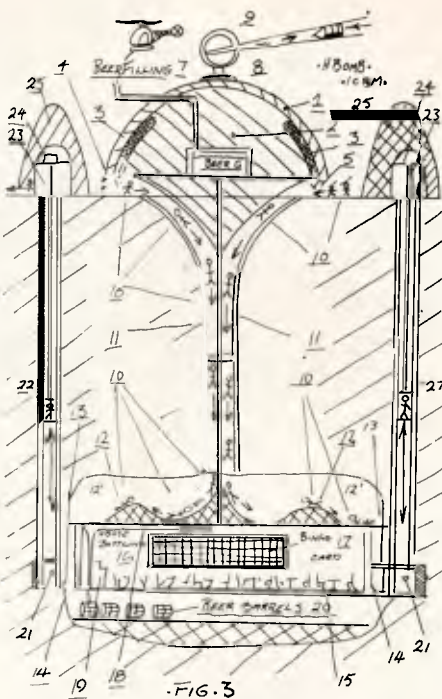


Figure 3 shows a schematic view, as a vertical cross section, of a completed *H* bomb shelter, as developed from a crater originally excavated by the explosion of a bomb.

An upper shell of very strong, thick, steel, proof against the blast from a near miss *H* bomb encloses a radiation shield of concrete 2, and two slidable doors or shutters 3 which can be released, to seal off the entry area 4 and 5, for World

citizens, 10, wishing to escape from the *H* bomb ICBM attack. Within the shell 1 is a reservoir for beer 6, which can be filled from a filling funnel 7 by a beer carrying helicopter.



The shell 1 carries, at its top, a radar bowl and aerial 8-9, to give as long a warning as possible of approaching *H* bomb carrying ICBMs.

The radar assembly 8-9, activates an alarm hooter and World citizens, 10, make a rush through the entrances 4 and 5, and, on their bottoms, are accelerated by gravity at about 32 feet/sec², until they are falling freely down the central shaft 11, which, if deep enough, may enable them to attain a terminal velocity of about 150 mph.

When the approaching *H* Bomb carrying ICBM missile has about 10 seconds of flight left, the radar assembly 8-9 triggers a mechanism to release the slidable sealing doors 3, light beam photocells devices being used, not shown, to ensure they do not fall on a World citizen 10, who is a bit late reaching the shelter, due to old age or rheumatism, after which the shell 1 and its beer supply, is effectively sealed off from the *H* Bomb attack.

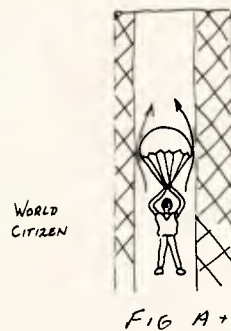
World citizens 10, after a free fall down the shaft, 11 landed on their bottoms, on a switch back system 12 of retardation high friction surface tracks, which slows them up so that their feet ultimately compress springs 12, and they are brought to a halt.

The World citizens 10 then get to their feet, and descend ladders 14 to the Cafeteria and Bingo Hall on floor 15, and, if they wish, can

take part in a Bingo Session using the Electronic Bingo Master Card, 17, on the wall. Refreshments, of a liquid character, may be obtained from the bar 19, from beer sucked up from barrels 20 in the cellar below, supplied through a pipe 18 from the gravity tank 6 in the shell 1.

When the ICBM attack is over, World citizens 10 can, through access ways 21, take lifts 22, operated by lift machinery 24 in *H* bomb proof shelters 25, to the access ways 23, and have a look at the "World", to decide whether it is reasonably safe for them to resume their previous activities, or they may decide they will return down the lifts to have another Bingo session, to let the level of radioactivity die down a little.

Figures A and B, of the drawings, show how the speed of descent of World citizens dropping down shafts leading to an *H* bomb shelter, created by exploding a Bomb, or down a tubular escape shaft forming part of an escape system from a conventional fire, can be retarded by making the tubes just larger than an ordinary umbrella, and the World Citizens can use such, or a specially provided small parachute, which they can clip on quickly, to provide aerodynamic braking of their descent.



WHAT I CLAIM IS:—

1. An arrangement for protecting "World Citizens" from accidental, or deliberate, attack by *H* Bomb carrying Inter Continental Ballistic Missiles, in which a deep underground shelter is created by the detonation, at a suitable depth, of a Bomb, the crater produced in this manner being provided with suitable facilities for recreative activity and liquid refreshment, a single central vertical shaft being provided between the surface of the ground beneath an *H* Bomb proof shield, and the crater shelter space, down which it is possible for "World Citizens" to fall freely under the influence of gravity, and lift shafts for them to return to the surface of the ground, after the completion of the accidental, or deliberate, attack by *H* Bomb carrying Intercontinental Ballistic Missiles.

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sinclair ZX80

-British made.

Until now, building your own computer could cost you around \$600 — and still leave you with only a bare board for your trouble. The Sinclair ZX80 changes all that. For just \$295 you get everything you need including leads for direct connection to your own cassette recorder and television. The ZX80 really is a complete, powerful full-facility computer matching or surpassing other personal computers costing much more. The ZX80 is programmed in BASIC and you could use it for anything from chess to running a power station.

Two unique and valuable components of the Sinclair ZX80: the Sinclair BASIC interpreter and the Sinclair teach-yourself BASIC manual. The unique Sinclair BASIC interpreter: offers remarkable programming advantages — unique 'one touch' key word entry. The ZX80 eliminates a great deal of tiresome typing. Key words (RUN, PRINT, LIST etc) have their own

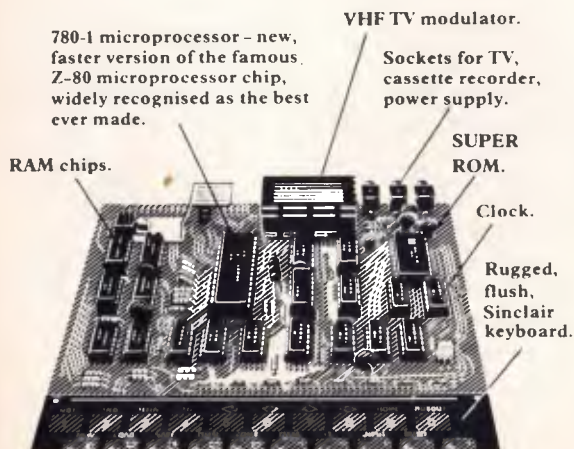
single key entry. Unique syntax check. Only lines with correct syntax are accepted into programs. A cursor identifies errors immediately, preventing entry of long and complicated programs with faults only to discover them when you run.

Excellent string handling capability — takes up to 26 string variables of any length. All strings can undergo all rational tests (e.g. comparison). The ZX80 also has string input to request a line of text; strings do not need to be dimensioned. Up to 26 single dimension arrays. FOR/NEXT loops nested up to 26. Variable names of any length. BASIC language also handles full Boolean arithmetic, conditional expressions, etc.

Exceptionally powerful edit facilities, allows modification of existing program lines. Randomise function, useful for games and secret codes. Timer under program control. PEEK and

POKE enable entry of machine code instructions. USR causes jump to a user's machine language sub-routine. High resolution graphics with 22 standard graphic symbols. The Sinclair teach-yourself-BASIC manual 96 page book free with every kit.

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PRINTERS

by Mike Dennis

There are over a hundred printer manufacturers in the world today and the wide range of facilities they offer frequently causes of a great deal of confusion. This month's exhaustive review sets out to explain how the various types of printer work and what options they offer; an easy-to-understand reference chart has been included to help you choose the printer most suited to your requirements. Every manufacturer and distributor whose name we could muster was asked to send as much literature (including operator and service manuals) as possible. Happily the response has been enormous.

For many of us, our first introduction to printers (or 'hard-copy' devices) was with the old teletype (TTY) . . . it was both excruciatingly slow and very noisy. Still, in its time the TTY was synonymous with hard-copy and it wasn't until the advent of the dot-matrix mechanism that any real change took place in the status quo. From that day on there has been a seemingly endless stream of improvements but, although the cost has dropped quite dramatically in a number of areas, the printer still comprises a major part of a system's total cost.

However, to the business user they are essential and, as program listings disappear off the top of the screen at an ever increasing rate, other computer users soon place a printer high on their list of priorities. The problem is — which one?

Basic concepts

Printers consist of three main components — the printing mechanism, a way to move the paper about and the controlling electronics. In addition there are other minor components such as a power supply, case and, where applicable, a ribbon. However, the heart of any printer is the printing mechanism itself and this is worth a comprehensive examination in its own right.

The first thing you notice is that some mechanisms are common to many printers. Some individual printer manufacturers buy-in the mechanism from an OEM supplier and then add the rest of the components to their own particular specification. This is one of the main reasons behind the proliferation of printers and, although the

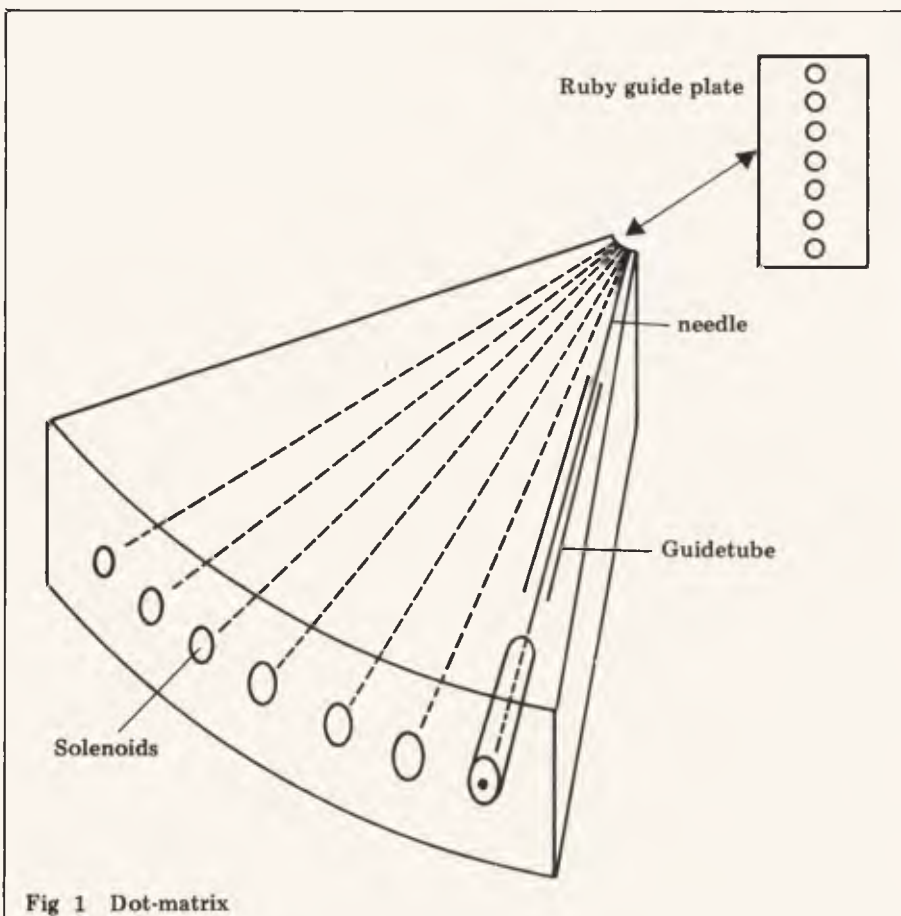


Fig 1 Dot-matrix

various suppliers were asked to disclose any areas of common interest, many were rather coy about it. Unfortunately that made true cost comparisons and value-for-money assessments all the more difficult.

The mechanisms themselves can be defined by three basic characteristics.

1 How the character is placed on the paper. *Impact* types such as the TTY use a hammer or similar object to strike the paper with the appropriate character. *Non-impact* types such as thermal printers as the name suggests do not strike the paper but use alternative methods.

2 How the character is formed. Fully-formed characters such as those in normal typewriters will print the whole character simultaneously. The alternative is to assemble the character by printing dots into a pre-defined

pattern — the dot-matrix. This implies several printing actions to print one character whereas fully-formed characters require only one.

3 The number of characters printed or assembled at a time. If it's only one character, then the printer is a *character* printer. The alternative method is to print a whole line of characters in one go — the *line* printer.

All the various types of printers are summarised in Table 1 according to their characteristics; these I shall now examine in greater detail.

Impact printers

The earliest form of impact printer was the ubiquitous teletype or teleprinter and models such as the Creed 7B can still be picked up for around \$50 on the second-hand market. The characters to

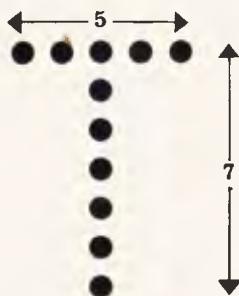


Fig 2

Table 1	
IMPACT	NON-IMPACT
Dot-matrix	Thermal
Golf-ball	Electrosensitive
Daisy-wheel	Ink-jet
Drum	Laser
Chain	Electrographic
Comb	
TTY	
Spinwheel	
FULLY-FORMED	
CHARACTERS	MATRIX
Golfball	Dot-matrix
Daisy-wheel	Comb
Drum	Thermal
Chain	Electro-sensitive
Spin-wheel	
TTY	
CHARACTER	LINE
Golfball	Drum
Daisywheel	Chain
Spinwheel	Comb
TTY	
Dot-matrix	
Thermal	
Electrosensitive	

be printed are arranged as small printing elements or 'type-slugs' and they lie in grooves around an annular ring. As the code for each character arrives at the TTY, this ring is rotated until the correct element is in the firing position. A hammer then strikes the element which in turn presses a ribbon against the paper and the character is typed.

Each element has to be capable of printing two characters since there's insufficient room to fit all the elements around the ring. Shifting between the two character sets is accomplished by moving the whole carriage assembly on which the paper is mounted. Upon receipt of the 'figures' code, the carriage latches mechanically and thereafter all printing codes access the figures character set. The mechanical latch is reset to its other position only when the 'letters' code arrives, and from then on the 'letters' character set is printed.

Not a lot happened in the printer world until the arrival of Centronics and the dot-matrix mechanism. Early examples of this type of mechanism shared one common feature, namely a vertical row of pins or needles that were attached to solenoids or electro-magnets. When energised, they 'fired' the needle at the ribbon and thus made a mark on the paper — see Fig 1. The

actual number of needles fired at any one time would depend on the character to be printed; the print-head mechanism or needle assembly would then move one column along, fire the next selection of needles and so continue to build up the desired character until complete. For example, the letter B would require all seven needles to fire for column 1 whereas the letter T would only need the top needle. Thus any character could be made up or assembled by firing the pins in a pre-defined dot-matrix. As can be seen from Figure 2, the early matrix dimensions had five columns and fired up to seven needles.

Since the needles needed to hit the paper both quickly and hard in order to maintain print quality and speed, the solenoids had to be large and powerful. This, in turn, meant that the needles had to be bent to make room for them which, in turn, meant more friction and heavier hammers. As the needles slid up and down their guides a couple of rather unpleasant things happened. One, the tube bores wore out and two, the friction generated heat, reducing maximum operating speed and useful life. Another disadvantage with the somewhat limited matrix of 5 x 7 was the comparative coarseness of the printed characters — diagonals in particular suffered badly.

The first problem has been cured in a number of ingenious ways. The early arrangement was for mounting the solenoids in the horizontal plane but since this has meant angling some of the needles quite severely many manufacturers now mount them radially. Thus the needles don't have to be bent as much which in turn means lower friction and wear, and less heat generation — resulting in an improved printing rate and head life. Another bonus is that the needles can be made harder which again enhances the print quality and head life. As you can see many compromises have to be made when designing dot-matrix heads and it's hardly surprising that firms like DRE use computer assistance to optimise head design.

Another improvement is to separate the needle from the driving solenoid; this is the basis of the 'ballistic' or 'free-flight' head. The principle is to hold the needle back against a spring and to release the stored energy at 'fire' time. After the needle has printed the dot, it rebounds and this rebound energy is used in conjunction with a smaller

solenoid to compress the spring again, ready for the next release — see Figure 3.

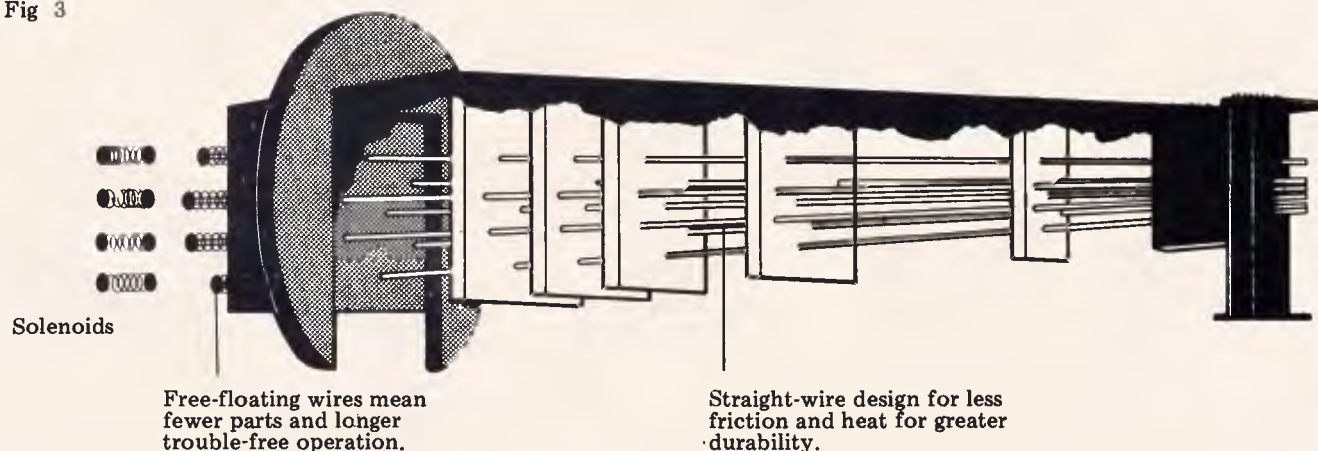
This idea of storing energy appears in Facit's Stored Force Flex Hammers. Here the solenoids are arranged in a semi-circle and the needles are replaced by very hard 'pips' mounted directly onto the armatures; these pivot when the power is applied. This drives the 'pips' towards the paper and, providing the hammer travel is kept low (so Facit claims), head life is lengthened considerably — see Figure 4.

The problem of legibility has been partly overcome by the use of finer matrices — such as 7 x 7 or 9 x 7. Table 2 lists the currently available formats and Fig 5 shows a 9 x 7 half space float. In fact, some of the dot-matrix formats are so fine that Japanese (or Katakana) characters can be printed — which is really going some. Of course, since each needle can be fired individually, it didn't take the printer manufacturers long to realise that virtually any character could be printed provided the original matrix dimensions were fine enough (hence 7 x 9) and the necessary control was available (at this point, enter the microprocessor). This explains the Nx9 or Nx12 that some manufacturers supply, the N meaning that the number of columns needed to make up a character is a variable and under program control. If a large

Table 2			
Common formats		other formats	
H	V	H	V
5	7	6	7
7	7	8	7
9	7	8	8
9	9	10	9
N	9	11	9
N	12	15	14

number of columns is used then the fidelity of the printed character is improved and approaches that obtainable from a typewriter. An increase in characters can be printed, although many printers have no lower-case descenders. This gives rise to that horrible looking format where the tails of p, q, y etc. sit up on the line... thus pQY. Some of the 7x7 formats boast true descenders but very often the descender is in fact quite minimal. You really have to buy a printer with a 9 needle head if you're after superb descenders; then you're also likely to get underline capability as well.

Fig 3



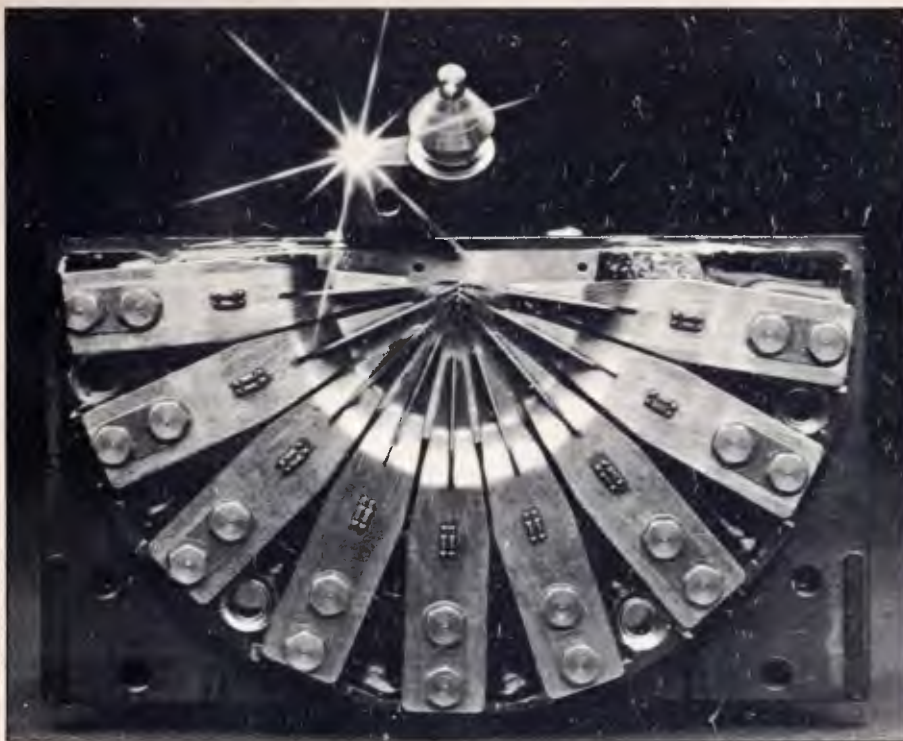


Fig. 4

There are many other advantages to be gained from microprocessor control and some of these will be discussed later. However, one significant trend emerging and, currently being marketed or developed by a number of manufacturers (such as Binder — Racal Recorders — and Centronics) is the dual-purpose printer. These work on a fine dot-matrix format that's capable of typewriter quality printing. This is of particular importance in word-processing applications. There's a penalty of course . . . in this case a slowing down of the printing rate because more dots have to be printed per character. When speed is of prime importance (such as when printing listings) then the matrix format can be 'coarsened-up' for much faster output.

The nett result is to have two printers in one and the ability to switch between the two types of performance with a software switch. The Binder 41 32KP can either print a standard dot-matrix at 240 cps (characters per sec) or a 'correspondence' font at 85 cps. Currently the average price of this type of printer is still high but I wouldn't mind betting it'll drop quite a lot before too long.

I've dwelt on dot-matrix printers at some length — because it's in this area that some of the most exciting developments are being made. However there are other types of impact printer.

Daisy-wheel print elements are very similar to typewriter slugs in that they're fully-formed although in this case, mounted on the ends of radiating metal spokes — see Fig 6. You can see, perhaps, a slight similarity with the TTY. Upon receipt of the appropriate character code, a ROM inside the printer will effect rotation of the wheel so as to correctly line up the wanted character with the hammer, and also decide on the appropriate hammer velocity. The wheel is then struck. Currently, the number of characters or 'petals' on a wheel is limited to a maximum of 96 although Qume does offer the facility of simultaneously

mounting two daisy-wheels at a time, making a total of 192 available characters. The alternative to this is to use the 'spinwheel' as used by the NEC Spinwriter. Here 64 petals are bent up, effectively increasing the radius and enabling 128 characters to be fitted (there being two characters per petal).

Apart from the obvious advantage of superior print quality, one daisy-wheel can also be easily exchanged for another of different typeface; there are over 100 such typefaces currently available. There are differences too in the materials used to make the wheels, Qume tending to opt for plastic, with Diablo preferring metal (although I see that it does now offer both). There are arguments both for and against and, although metal wheels last longer, with plastic wheels coming out at around a third of the cost, that's one argument that doesn't hold much water. The only slight advantage that metal wheels have is in producing a marginally crisper print. Plastic wheels, however, are so cheap you can stock up with three times as many different typefaces for the same cost. Yet another advantage of plastic wheels is that, being lighter and therefore possessing less inertia, they can be spun round faster than metal ones. The printing speed — always one drawback of the daisy-wheel — is typically a maximum of 55cps with plastic wheels and only 45cps for metal. For many uses this speed is too low and you can see why there is the feverish development in matrix printers that I discussed earlier.

Another feature of daisy-wheel printers, often overlooked, is that if you purchase the version with a keyboard (which usually costs about another \$400) since you can operate it in a 'local' mode, you've effectively made yourself an electric typewriter for only \$400! Where else can you buy one of that quality and at that price? And a final plus . . . the daisy-wheel is the only printer I know of that's capable of printing sub and super-

scripts.

The last of the impact devices to be considered (at least as far as 'character' printers are concerned) is the faithful IBM Selectric and variations thereof. These are now appearing on the re-furbished (second-hand) market with suitably modified insides and an interface to suit your computer. The printing mechanism in this case is a golf-ball; a fully-formed character printer, the individual symbols are raised up from the surface of a metal ball. This ball is attached to a mechanism of almost frightening (well, it is to me!) complexity which twists and raises the correct portion of the ball into the firing line. In common with other hairy mechanical devices, the golf-ball print speed is quite slow — about 15 cps. The print quality, however, is superb . . . some would say the best as it's effectively an electric typewriter. Again, it offers the advantage of having exchangeable typefaces, although you have to be 100% certain that the electronic interface fitted can handle your choice; with the differing golfball layouts available, you might well end up printing gibberish.

Non-impact printers

The two main types of non-impact printer are electro-sensitive and thermal. Both operate on a similar basis to matrix printers but instead of needles they use (respectively) an electric field or a heat field. Both require special paper and the electrosensitive type is that nasty looking silvery stuff. The thermal paper is creamy-white in colour and produces quite a readable print . . . far less objectionable in my opinion. A typical price for thermal paper is \$4.00 for an 80' roll — which makes it fairly expensive — while the other type is cheaper. The advantages of both thermal and electro-sensitive are a relatively high speed (about 40 cps for the Trendcom 100 thermal printer) and an almost sublime silence when in operation — it sounds so effortless. One possible disadvantage, apart from the special paper, is that the paper width is sometimes limited (less than 5") but there's an increasing number of manufacturers (Trendcom included) now offering an 8½" width.

Another, perhaps more serious, disadvantage inherent in both designs is that only one copy can be made at a time as opposed to up to 6 that some of the impact printers can manage.

Typewriter modifications

Last but by no means least in the mechanisms is a strange beast that defies any classification in the printer camp per se. I refer to the Keypak which is a handy device and clips over an existing electric typewriter keyboard. Small solenoids in the Keypak then depress and actuate the existing typewriter keys. Restrictions are that the typewriter must have a powered carriage-return and a certain amount of adjustment of external timing delays is needed to suit the particular typewriter used. What you get is, effectively, correspondence quality print at whatever maximum speed the

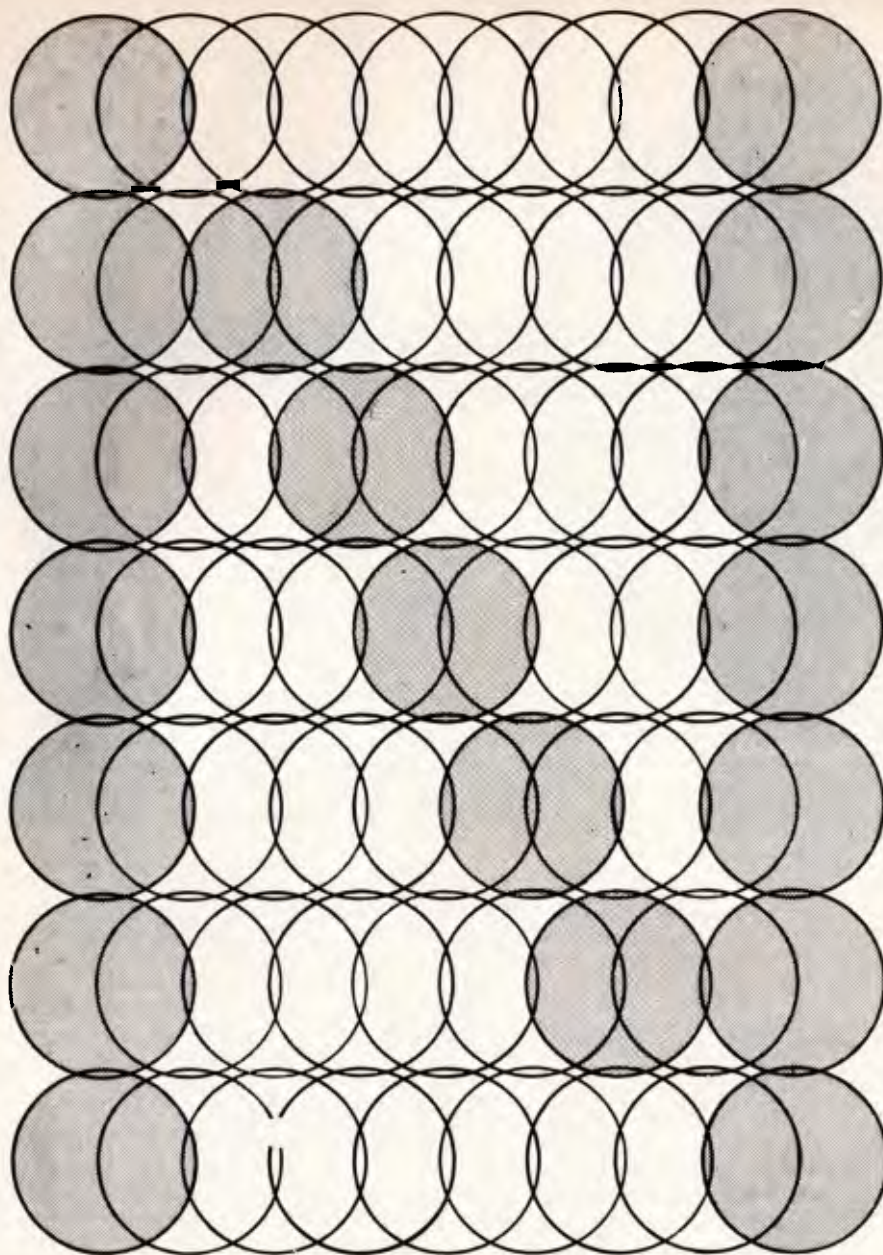


Fig. 5 9 x 7 Half space matrix font

typewriter will run. I also hear rumours of another add-on that lives underneath the keys but was unable to find out any more information on it.

Line printers

If throughput is a problem then the line-printer is just the job for you, although you will find most of them rather expensive. Three methods of printing are used — namely the drum, the chain and the comb all of which print a complete line in one go. Both drum and chain methods use fully formed letters and also strike the *paper* against the ribbon and then on to the character on the chain or drum. This is known as 'back-striking', as opposed to the 'front-striking' mechanism of the ordinary typewriter where it's the character that does the striking. In the drum printer, the characters are arranged in rows down the axis of the drum — a complete row of 132 A's (assuming it's a 132 column printer), then a row of B's etc. Behind the paper is a row of 132 hammers, each being activated when the appropriate character passes it. For one line of print to be made the drum must revolve once. The paper then

moves up to the next line and the process is repeated.

The chain, or train, mechanism comprises a series of metal slugs joined together and driven along a guide channel in front of the paper and ribbon. Each slug comprises one character and, when it reaches the appropriate column, the paper is struck from behind by the corresponding hammer — very similar in fact to the line printer.

A closely related mechanism is used by the band printer but this time the characters are impressed on a metal band that is then used in a similar fashion to the chain or train. One advantage of the band printer is that bands can often be changed quite easily, to effect repair or font change. If the character set is duplicated in either chain, train or band then a speed improvement will result. The actual number of hammers also varies and the maximum throughput occurs when there is one hammer per column on the paper. This makes the printer correspondingly more expensive and so, to compromise, some printers share one hammer between two or four columns and the mechanism or the paper is

moved sideways during printing.

The third type of line printer uses the 'comb' mechanism. Pioneered by Tally it's a compromise between the number of active elements (hammers) and the printing speed. The comb has 132 teeth and on the end of each tooth is a hardened 'pip' — see figure 7. Behind the tooth is, wait for it, yes — an electro-magnet! The design is quite ingenious because, to print a dot, the required comb is pulled back with the magnet and then released . . . whereupon the tooth flies back and strikes the ribbon on to the paper. This is only the first dot in the character that we are building up and the comb is then moved sideways to the next dot position within character and the required teeth fired. Don't forget that since we have 132 hammers we could be building up 132 characters simultaneously. When all the dots have been fired for the first row, the paper has to be advanced by one dot row position ready for the next row of dots to be printed. However, to save time the comb row moves over in the opposite direction. The comb therefore reciprocates along the print line, making $3\frac{1}{2}$ complete cycles per character row — see Figure 8. The end result is a printer with no fast-moving parts or requirement for critical timing.

A different principle is used by OKI in its line printers. Here either 22 or 33 small solenoids are used with the needles attached directly to the armatures. Because they are mounted at right angles to the paper there's no question of bending the needles and so normal dot-matrix type problems are eliminated. Each hammer or solenoid is shared between 6 or 4 characters respectively and each character is then assembled in a similar fashion to the 'comb'.

Cautionary note

The important point with any quoted line speeds/minute is that it depends on the number of characters per line, and this applies to all types of printer. Also remember that although a uni-directional printer may be quoted as having a printing speed of 120cps — time will be wasted while it does a carriage return. The effective throughput will be less than a printer running at the same quoted characters/sec, but with bidirectional printing capacity.

Paper control

There are three main types of paper movement or control, the most common being the 'pin-feed' which uses computer listing paper with sprocket holes down each side. At the end of the platen (the roller that the paper goes round) are spikes or 'pins' that locate with the holes in the paper and drive it along at line-feed time. The drawback with early versions was that the distance between the sprockets was fixed and so you were stuck with using only one size of paper. The alternative was to purchase different platens to suit different paper types and some manufacturers have gone along that line by simplifying the changeover procedure.

Another method is to do away with the platen altogether and have a



Fig 6

narrow strike plate behind the paper fire-line and then to pull the paper over this plate. In this case the sprockets are mounted on a separate rod along which they can be slid to accommodate different widths of paper. The disadvantage with some of these pin-feeds is that the paper is not under very tight control as there is no tension holding it back below the print line. This turned out to be a problem, especially with forms such as invoices etc, and so the adjustable tractor was developed. This device (standard fitting for some, while an optional extra for others) can be adjusted for paper width and also provides a firm 'traction' path through which the paper is driven. Another feature is that for about 3 inches above the print line, the paper is held flat which makes reading while printing much easier. This 3 inch path also means that there are more teeth in contact with the paper than with the pin-feed and so there is less chance of the paper jamming or tearing.

Where the control of paper movement is really critical — when graph plotting for example — then the technique is to use a double-tractor mechanism both before and after the strike plate. The paper is therefore really gripped tightly and pulled hard back against the strike plate. The double-tractor also means that the paper can be moved backwards which again is a great asset when graph plotting. Don't automatically think that the forms-tractor is always better than the pin-feed because some of these

tractors that are optional extras can move about a bit, albeit by only a tiny amount . . . a small point that you should be aware of.

The next method is the friction feed and this is used where sprocket holes are taboo — for instance when writing to your girlfriend! The operation is identical to a typewriter and usually works fine. The only problem arises when continuous stationery is used as, after a time, no matter how carefully you insert the paper it will gradually creep along the roller; you end up typing off the sheet.

Friction feeds are definitely for those who detest invoices with holes down the side. The alternative name to this feed is the 'single-sheet' feed and, as the name suggests, you put in the sheets one at a time. Well, computers are supposed to save you time, remember, and it can be irritating to stand around feeding the thing. Therefore a handy gadget to have at this time is the single-sheet feeder which takes approximately 200 single invoices or letter heads and will feed them one at a time into the guts of the printer, print them and then stack them up neatly for you in a little tray!! The drawback is that the gadget costs about \$1500 and tends to be used only with daisy-wheel printers.

Paper can be fed or loaded into the printer from a number of directions. One of the easiest is from the top where it goes in like a typewriter, and one of the worst is where it goes in the back — as in the Microtek. Other options offered are bottom feed and front feed, although bottom feed may be a

factory fitted option.

Many printers fit 'paper-out' indicators that either light a lamp or buzz where appropriate. Among the paper terms that you may come across is 'fan-fold' where the paper is folded alternately, as in a fan; this makes storage of the printout much more manageable. Most printout paper is fan-folded. Some paper comes as two-part and with or without a carbon; copies can be easily made. If you're going to make copies, then make sure that your printer is capable of producing the required number at a time. Printers such as some Facit models feature a 'floating' print head that automatically compensates for different thicknesses of paper whereas some others need the hammer intensity and head adjustment to be performed manually.

There are extra features that are worth looking out for (which are not always automatically provided but that you might find important) . . . for instance printers with facility for winding the paper forward or backwards manually; it's also nice to be able to tear off the paper at a convenient point. Many printers have the tear-off point some way on from the print line which means that you can't start new sheets from the top of the page.

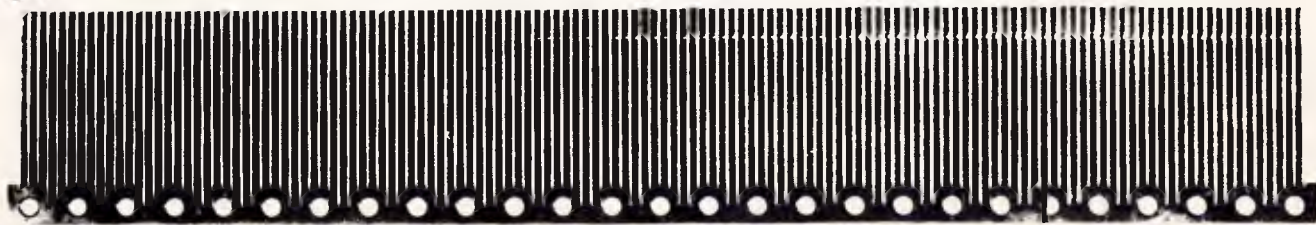
In general terms paper handling is fairly straight-forward and there aren't usually any great problems. Remember, though, that friction feeds do mean that you can print on virtually any form of paper . . . even stencils and offset litho masters and that is often quite important.

This next section is one closely associated with paper — the choice of ribbon. Features to look out for here are the life of the ribbon, how easy it is to replace and how much it will cost. The current buzzword appears to be the 'Mobius' loop where both the top and bottom halves of the ribbon will eventually be used. Some use 'intelligent' ribbons — such as Qume's Multistrike which is supposed to wind the ribbon on only as far as the width of the last printed character, thereby lengthening the ribbon's life. For really excellent print quality you need a 'singlestrike' (or carbon) ribbon which, although producing exemplary print, only lasts for one pass and then has to be thrown away. Some printers feature two-colour printing (usually red and black) and there's even a superb colour printer by Trilog that uses a three colour ribbon in the company's own colour plotter/printer.

Taking Control

Some of the modern trends in micro-processor control have already been mentioned but, before I expound on the

Fig 7



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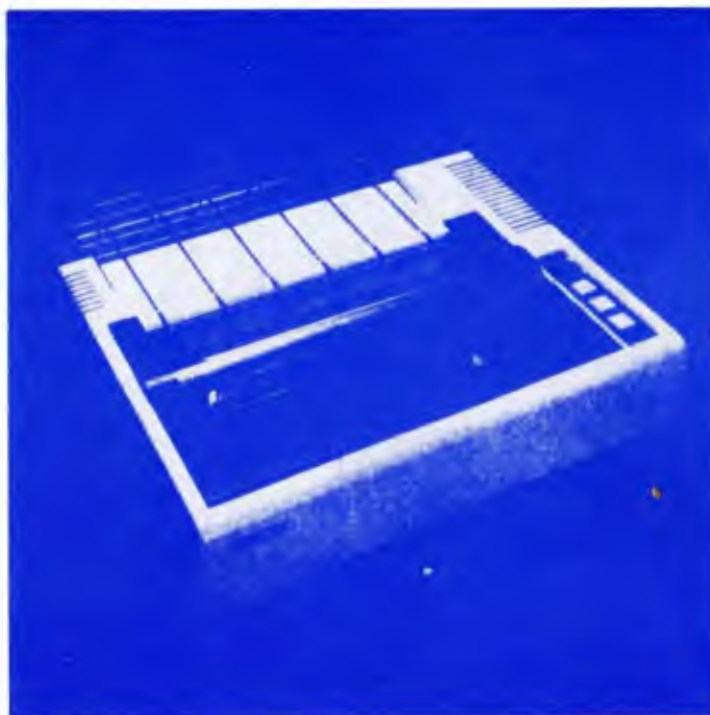
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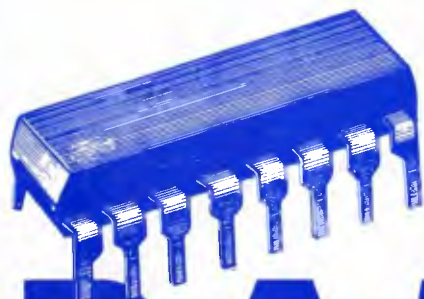
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Why buy a dedicated word processor when for less money you can have a complete computer system!!

other advantages, I ought perhaps talk a bit on the simpler (?) task of interfacing. Printers interface to their host computer via either a serial or a parallel interface.

Because printer mechanics are much slower than electronics, many serial interfaces operate at a slow baud rate. Sometimes the maximum speed at which a printer will work (eg. 55cps) falls between two of the standard electronic baud rates — here, 300 and 600 baud. If the computer transmits at 300 baud then the printer is not being used at its fastest pace but at 600 baud, the speed is too high for it. The answer adopted by many manufacturers is to include a buffer (usually up to around 2k) inside the printer which will absorb occasional bursts at the higher rate without losing any characters. The problem of baud rate matching is still there and if the computer transmits a large chunk of data — eg. a listing — then the buffer will overflow in a very short time. If this type of operation is anticipated, it's important to make sure that whatever serial interface is used possesses a handshaking control that can inhibit the computer from sending any more data after the printer buffer has been filled up.

The proper answer is to use a parallel interface and there's a so-called standard — the Centronics interface. Many people advertise that they follow this standard but occasionally I have known people to run into trouble; certain elements within the interface didn't quite tie up as well as they should have — check therefore that your computer will interface satisfactorily. Handshaking is inherent in parallel interfaces and thus data transfer rate is not a problem.

Another aspect of control is the VFU or Vertical Forms Unit which uses tape cartridges, punched tape or micro-processors and ROMs to govern the vertical movement of paper. The simplest example is the 'forms-length' switch that tells the printer how many lines there are on the form, thus enabling it to move the top of the next form after the previous one has been printed. I refer, of course, to continuous stationery. Other, more sophisticated, VFUs allow movement to one of several predefined positions on, for example, an invoice. These might mark the head of form, the start of an address, the first item line and the total box. Some manufacturers even provide battery backup to maintain the forms information in the event of a power failure!! The whole trend seems to be to shift a lot of the intelligence associated with form presentation from the computer into the printer and to offer the user more and more flexibility; personally I think that too much flexibility can often confuse the issue.

The matrix printers also have a field day, thanks to microprocessor control. Apart from those facilities that I've already mentioned, there are other goodies such as the ability to change the number of characters per line or even to print double height, width or size characters; others allow multiple printing passes along the line to build up exotic characters. The enhanced matrix printers are heavily microprocessor

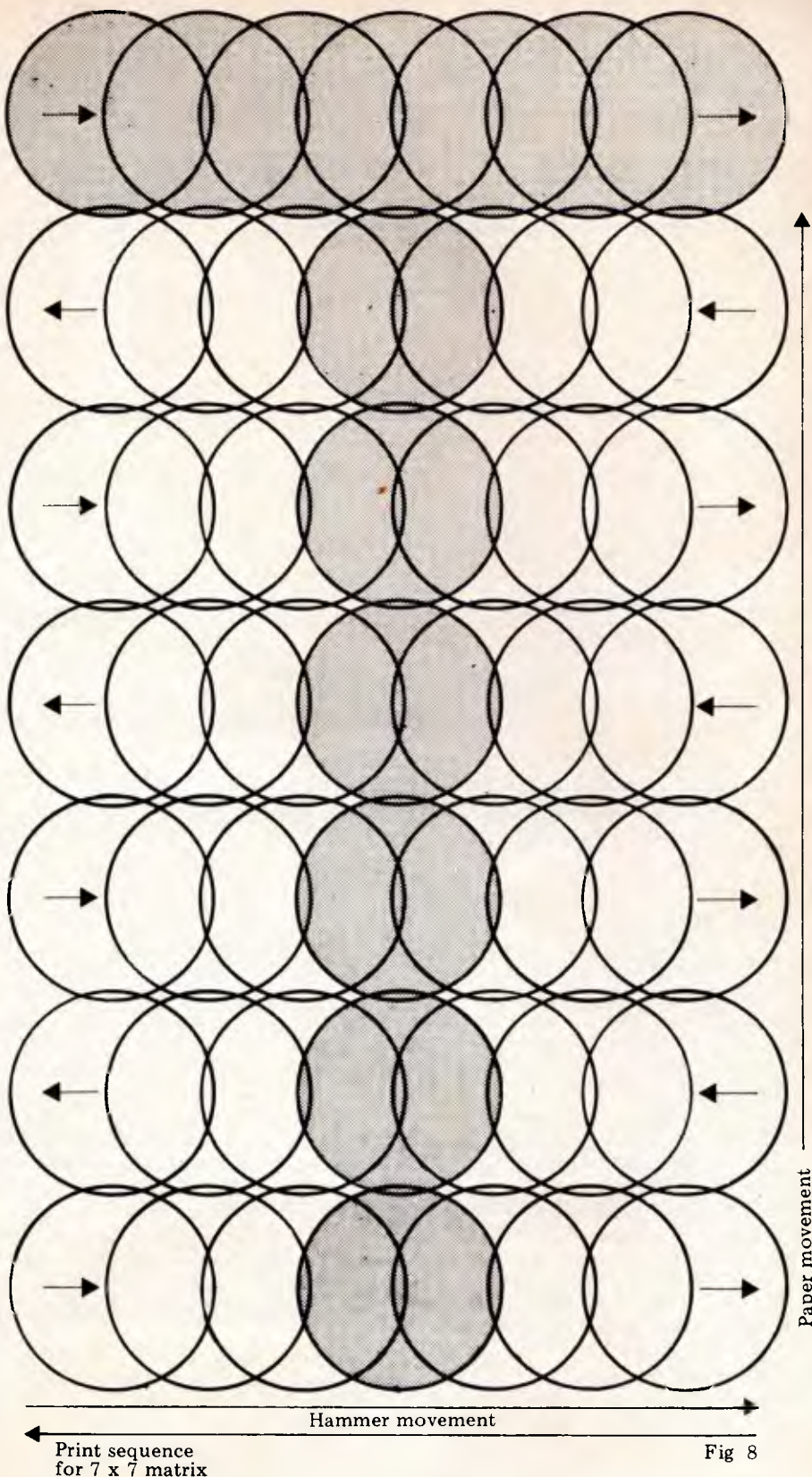


Fig 8

controlled and perform many of these functions.

Word processing hasn't been ignored either as several printers will justify the text for you and proportionally space it. The principle behind proportional spacing is that for ease of legibility each letter doesn't occupy the same horizontal space. When allowance is made for this fact (ie. the print head doesn't move along the same amount for each character) the result looks much better.

Conclusions

I hope the foregoing has given prospective buyers some help in finding their way through the printer jungle. If I could crystal ball gaze then I'd say hang fire for a while as I suspect there are some interesting printers lurking in the wings, particularly in the area of dual-purpose and enhanced matrix printers. My advice for buying is to take your time and to decide what exactly are your requirements before

looking at any printers. That way you stand least chance of being swayed by all the frills and furbelows in your search for the printer that's right for you. Also important, of course, is that you buy at the right price.

Using the chart

You will find that many figures in the chart are approximate; you should therefore only use it as a 'broad-brush'

outline for making a preliminary choice. Where options are available they are indicated and a brief word given on the facilities offered. Don't assume, because a feature is missing, that a particular printer hasn't got it. It may mean that it simply wasn't mentioned in the literature. The converse may also hold true. Another point to bear in mind is that many facilities are inter-related — such as selection of characters per line versus speed.

To repeat, this chart is by no means

exhaustive although it certainly exhausted me preparing it!! Make a few preliminary selections, send for the actual literature and, armed with your new found knowledge, ask a few pertinent questions.

A few printer/keyboard combinations that are usually considered as being terminals are not included in the chart, the distinction in some cases being a bit nebulous.

		Anadex			Centronics						
Model		DP 8000	DP 9500	Base 2 M80B	700	701	702	703	704	730	737
Print mechanism type		DM	DM	DM	DM	DM	DM	DM	DM	DM	DM
Line or character		CR	CR	CR	CR	CR	CR	CR	CR	CR	CR
Speed cps	Max	112	200	80	60	60	120	180	180	100	80/50
	Min		120								
Lines/min	Max		200		90	120	260	370	400		
	Min		60		13	25	50	70	70		
Characters/line	80										
	132										
	other		175/220	72/96/120							
Characters/inch	horizontal		10/16		10	10	10	10	10	10	
Lines/inch	vertical		6/8	6	6	6	6	6	6	6	
Proportional spacing											
Bidirectional printing											
Justification											
Multiple copies											
Ballistic head											
Matrix format		7x9	7,9 or 11 x9	7x5	7x5	7x5	7x7	7x7	7 or 9x7 or 9x9	7x7	Nx9 or 7x8
Change print size											
Change type font											
No. in character set				21					96	96	96
Headlife (million chrs)			100/650	100							
Descenders											
Underlining											
Ribbon life (million chrs)	normal			5							
	carbon										
Mobius loop type?											
Graphics											
Bidirectional movement											
"in feed											
Factors											
Dual tractor											
Paper widths	Min									4	4
	Max									10	10
Friction feed											
Sheet feeder											
Paper cutter											
Serial interface											
Max baud rate		9600	9600	19200					9600		
Buffer	Opt.	2048		1920							
	Fixed	12							256	80	
Parallel interface											
Parallel transfer rate (ch/sec)		1000									
Self-test											
VFU					Operator	controlled					
Switchable forms length					Horiz. &	vert forms posn.					
Punched tape											
8 Channel cartridge											
Electronic + No. channels											
Paper-out sensor											
Measurement in inches	width	19	27	14	25	25	25	25	25	15	15
	depth	14	15	10	20	20	20	20	20	11	11
	height	7	8	3	8	8	8	8	8	5	
Approx weight (lbs)			35	9	60	60	60	60	60	12	12
Cost		\$950	\$2000	\$800	\$2700	\$2700	\$3300	\$4100	\$4200	\$1090	\$1400

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Optional
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Please note the prices shown are only approximate and may vary substantially between dealers.

[illegible]

HY-Q 1000

The World's Most Intelligent Printer



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- Elite size type at 12 characters per inch
- Mikron size type at 15 characters per inch
- 1, 1½, 2, 2½, 3, 3½ line spacing
- Software select:
Normal print
Normal print, underlined
Bold print
Bold print, underlined
Reverse print (white on black)
- Automatic carriage return at end of line
- Automatic storage of often used formats (tabs, spacing etc.)
- Automatic storage of often used phrases
- Multi-lingual keyboard standard
- Receive only printer
- Automatic column layout
- Through-put printspeed of 20 CPS (Minimum)
- 13.2 inch printing line
- 17" paper width capacity
- 132 columns at 10 characters per inch
- 158 columns at 12 characters per inch
- 198 columns at 15 characters per inch
- Automatic paper feed
- Built-in anti glare shield
- Accepts carbon or fabric ribbon cartridge
- Various color ribbons available
- Automatic centering of titles
- Automatic printing of VERTICAL lines (to separate columns)
- Automatic relocation key
- All printing elements Multi-lingual
- Automatic decimal point location
- Automatic carriage positioning
- Electronic digital readout to show:
Number of characters till end of line
Number of lines till end of page
An existing error condition
Selected automatic functions
- Switch selectable strobe, busy and acknowledge polarities on centronics 779 interface
- Signal light indicates when in upper case
- Switch and software selectable upper case/lower case normal
- Signal light indicates when in auto column layout mode
- Allows carriage return without line feed
- Allows line feed without carriage return
- Electronic tab set
- Electronic tab clear
- Electronic tab key
- Function to cancel all tab margin and spacing formats
- Electronic margin set
- Electronic margin reset
- Automatic backspacing of 1/10, 1/12, 1/15 or 1/60 inch
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 Standard

	Paper Tiger	Qume			Terminet			
Model	Paper Tiger	Sprint 5	M 80-MC	MT 1602	200	OMNI 820RO	OMNI 825RO	810
Print mechanism type	DM	DW	DM	DM	DM	DM	DM	DM
Line or character	CR	CR	CR	CR	L	CR	CR	CR
Speed cps								
Max	198	55	200	160	200	150	75	150
Min	57	45	140					
Lines/min								
Max	275			200				440
Min	42			70				64
Characters/line								
80								
132								
other	96/134	158			136/224			
Characters/inch horizontal	10/16			10	10/16.5			10
Lines/inch vertical	6/8		8	6				6/8
Proportional spacing								
Bidirectional printing								
Justification								
Multiple copies			5	5	8	5	3	6
Ballistic head								
Matrix format	7 or 8x7		7x7*	7x7*	9x7	9x7	9x7	9x7
Change print size								
Change type font								
No. in character set	96	96	64	96	100	128	128	64
Headlife (million chrs)			>100					
Descenders								
Underlining								
Ribbon life (million chrs)								
normal								
carbon								
Mobius loop type?								
Graphics								
Bidirectional movement								
Pin feed								
Tractors								
Dual tractor								
Paper widths								
Min	2				2	3	3	3
Max	10				16½	15	15	15
Friction feed								
Sheet feeder								
Paper cutter								
Serial interface								
Max baud rate		1200			120	9600	600	9600
Buffer								
Opt.								
Fixed	2048				2/256	1280	256	256
Parallel interface								
Parallel transfer rate (ch/sec)								
Self-test								
VFU								
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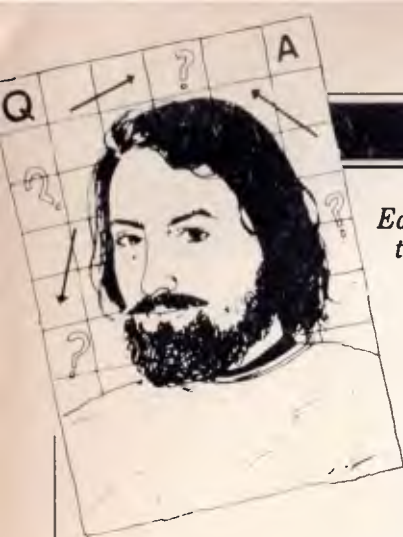
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COMPUTER ANSWERS

Each month Sheridan Williams and his panel of consultants answer readers questions. Topics may be hardware — from kits to mainframes, or software — from differential equations and statistics to file handling or sorting; the choice is yours.

Into the unknown

With regard to the Sinclair ZX80 and the Acorn Atom: (1) Would it be possible for a user to construct a printer interface for the ZX80 that's currently on the market? Which printers would be suitable?

(2) Would the fact that the ZX80 has a Z80 type CPU rather than the Atom's 6502 give the ZX80 any great advantage so far as the user is concerned?
L Wood.

I never fail to be amazed by what some people get up to! However, I shall assume in this case you mean an average user, without specialist electronic expertise, but with the ability to follow instructions carefully — and who can solder well.

Taking that as our basis, then I think I must answer 'no' to your first question. The ZX80 is indeed ingenious in offering the facilities it does — in a compact unit, and at a low price. However, this is achieved at the expense of a number of non-standard (perhaps I should say 'innovative') features. These combine to make the interfacing of a standard model of printer a difficult matter.

For a start, virtually all printers (apart from IBM ones, and Telex printers) use the ASCII character code. The ZX80 does not. That means you would have to use a lot of the ZX80 memory to contain a code translation program — or have another micro between it and the printer do the job!

Secondly, the I/O routines make more than one use of some areas of memory (hence the screen blanks out during keyboard input and program running) ... therefore I/O routines are also non-standard.

And finally you need to buffer the bus lines before really contemplating connecting anything to them. I'm sure someone will soon prove me over-pessimistic by letting us know how they've attached a printer to a ZX80; for the rest of us it's a question of waiting for the special Sinclair printer to become available.

On your second question once again the answer really hinges around 'who is the user'. If you are only working in Basic (or some other high-level language) then there is really no noticeable difference in principle between machines using 6502s and those using Z80s. In fact, other things, such as the particular implementation of Basic used with your machine, will cause the most marked differences. The one that might show up is speed, and then only if the Z80 is a Z80A being run at a full 4 MHz. Even then, I sometimes wonder if a difference in speed of that order is significant to the typical amateur user.

Where the differences do show up is in machine code, or assembler language programming. Even then, while the Z80 has a more powerful instruction set, there are those programmers who prefer to work with 6502 assembler language. So, to sum up, the type of micro-processor used is unlikely to be significant in choosing between the Acorn Atom and the ZX80.

P McIlmoyle

Unadventurous games

I'm bored stiff with computer games that involve killing Klingons, Robots, Piranhas, Space Invaders, Androids, and who knows what else. I'm also bored with computer versions of chess, Othello, draughts, pontoon etc. What's next, other than suicide?
J James.

How about a game called 'Adventure'? There are dwarves, dragons, trolls, pirates, snakes and other nasties in this game and it's up to you whether you kill them or not. As you have this aversion to killing perhaps you could try 'stroking' them instead.

Adventure is a totally different type of computer game, unlike any that you will have seen already. Before you get too excited, there might not be a version available for your machine, and even if there were it would not be worth getting unless you had disks. Still we can dream; let's assume that it is available for your machine.

Here's an analogy: If you think of most computer games as 'films' then Adventure can be likened to a 'book'. In a film you are given very little chance of fantasising, but with a book you can conjure up your own mental pictures. Adventure is like that. It is an adventure story that you can control, the object being to find your way into a cave system and collect lots of hidden treasure. The more you collect the greater your score. Along your journey a great many things can happen and you must find the correct course of action to proceed. Before you think 'yawn' I must tell you that when I tried Adventure it totally ruined a whole weekend. I started playing at 10am on Saturday and apart from about six hours' sleep, I was still playing at 1130pm on Sunday night! And I still only scored 200 out of 380. In other words, I had only covered just over one half of the cave system and this was only a small version of the game. The versions I have used are on a PDP11 and an RML 380Z. If you can get a copy then jump at the chance.
Sheridan Williams

Program puzzle

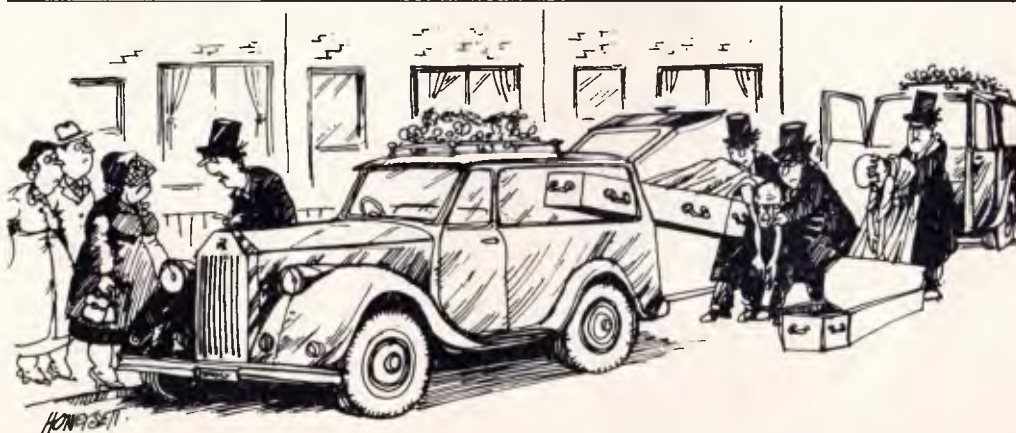
I've seen expressions like X=A AND 127 in programs and I can't work out what they are. Can you help? H Elliott.

You will need to know a little about binary and machine code to actually understand their purpose rather than just what it is they do. Essentially the statement above chops off the left-most bit of an 8-bit byte. The operators AND, OR and NOT are called logical operators. If 0 represents 'false' and 1 (on some Basics -1) represents 'true' then here is a table for the most commonly used operators:

A	B	A AND B	A OR B	A EQV B	A XOR B
0	0	0	0	1	0
0	1	0	1	0	1
1	0	0	1	0	1
1	1	1	1	1	0

There are others like NAND, NOR and IMP, but not many Basics support these. So, to answer your question; 127 in 8-bit binary is 01111111 and, if A has the value 10001111, then X=00001111. The expression you gave could be

replaced by IF A>127 THEN A=A-128. You can try PRINT 143 AND 127 in the direct mode. Be warned, however some Basics do not support logical operators in arithmetic expressions.
SW



"I'm most terribly sorry about this, Mrs Kewbeer, we've had no end of trouble since we installed a computer in the office"

**BENCH
TEST**

SUPERBRAIN



The early SuperBrain adverts seemed too good to be true — then subsequent delays in its reaching the market place sparked off rumours of trouble. Now that the SuperBrains are here, do they live up to those original ad claims? Sue Eisenbach investigates. . .

Hardware

The Superbrain QD is a single unit personal computer weighing approximately 23kg and with physical dimensions 54cm wide by 57cm deep by 37cm high. Both in appearance and weight it seems like a VDU and, in fact, Intertec do market several VDUs in the same, attractive, white and grey structural foam case. However, in performance terms, it is, of course, a far cry from the humble glass teletype. The top of the case is attached to the base by means of four securing screws. Inside, the system is seen to be divided into four self-contained modules — the keyboard/CPU; the disk drives; the shielded CRT and the power supply. All are easily accessible without further fiddling

except for the disk drives which require the release of another two fixing screws (each) before they are detached and available for inspection.

The heart of any SuperBrain is the CPU/keyboard module. This contains two 4 MHz Z80As — one to handle the processor and screen I/O while the other takes care of disk I/O. The SuperBrain QD comes with 64k of dynamic RAM as standard (32 4116s) whereas an ordinary SuperBrain comes with 32k as standard but with sockets for another 32k. The machine also has 1k of static RAM for use by the second processor and 2k of ROM for bootstrapping at power-up. The rest of the board contains the character and keyboard encoder circuitry, the disk controller (FD1791) and the communication elec-

tronics — including two serial ports (switchable synchronous or asynchronous) which are under software control. Thus baud rate, parity, the number of stop bits and the transmission mode can be set from the keyboard. A 22-pin cable connector handles power and signals and a second 40-pin Z80A data bus connector is available for future expansion. At the moment, according to the documentation, a Centronics compatible parallel interface can be connected directly to this bus. Also promised (but not yet available) is an S100 bus adapter to allow the attachment of a single S100 board inside the SuperBrain case, next to the disk drives.

The keyboard generates the full 128 ASCII character set. The 76 keys include a separate numeric pad with a

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SORCERER SOFTWARE

SYSTEM 2 by Richard Swannell loads into the top of available RAM and becomes an integral part of the BASIC language. All commands are single keystroke. SYSTEM 2 is written in Z80 and provides the following features:

1 **SCREEN EDITOR.** Use the editor to insert, replace, delete or rubout characters in your BASIC program. Watch the line change on the screen! Gone are the days of typing in a whole line to change one character!

2 **FUNCTION KEYS.** SYSTEM 2 allows 12 keys to be programmed to represent one or more characters or up to several lines of text each! After a key is programmed, by simply hitting key, all the text is sent to the processor just as if you typed it in on the keyboard! Function keys may be used in all modes of operation including the editor. This feature is handy for lengthy and/or often used commands and may include multiple statements.

3 **RENUMBERING ROUTINE.** With a single keystroke your program is renumbered. Starting line number and increment may be changed.

4 **BASIC BUFFER PROTECTOR.** SYSTEM 2 sends a (CR) when the BASIC BUFFER is full. This prevents BASIC from crashing.

5 **PRINTER DRIVER.** Simply hit CTRL P to direct output to Centronics printer.

6 **REVIVAL ROUTINE.** If NEW or CLOAD are typed or RESET is hit by mistake, your program may be recovered. This is a safety device.

OTHER FEATURES

- RUNSTOP stops execution until any other key is hit
- CLEAR clears screen then sends a (CR). Hit CLEAR to start on 'new page'
- CTRL characters such as ESC, LF and CLEAR don't return ?SN ERROR
- RUB doesn't require the SHIFT key to be depressed. This quickens editing
- Includes a Real Time Random Number Generator
- Returns automatically to BASIC after TAPE CRC ERROR while CLOADing
- Suppresses premature CRLF. Normally, if RUB is used extensively while typing in a BASIC line, the cursor will drop down to the next line before reaching the end of the current line. SYSTEM 2 prevents this
- SYSTEM 2 requires 2K of memory and is available in B, 16, 32 & 48K versions

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RS232 PRINTER DRIVER. Requires 250 bytes of memory and is relocatable. Suitable for MONITOR STANDARD BASIC, WORD PROCESSOR PAC & DEVELOPMENT PAC. Stores each character in a buffer then sends the whole line at once, which solves timing problems.

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SYSTEM SOFTWARE

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row of cursor control keys and an alpha-lock. A nice feature is the pair of red keys at the lower corners of the keyboard. When depressed singly these have no effect; when depressed together however, the system re-boots itself — a two-handed operation which makes an accidental re-boot very hard to do. The only way I could get the screen to clear was $\wedge L \wedge K \wedge J$ (where $\wedge$ = 'control'), which is not ideal.

The CRT consists of a 30cm P4 phosphor tube mounted in an aluminium chassis whose screen displays 24 lines of 80 characters. The white characters on a grey background are composed of a rather cramped 5x7 dot matrix on a 7x10 character field. The result is that some of the lower case letters are somewhat unconventionally formed, especially those requiring descenders — the whole gives a vague 'ransom note' impression. The video circuit is mounted in the base of the CRT chassis and is easily accessible.

The SuperBrain QD is supplied with twin Shugart double-sided, double-density mini drives (Model 450) which on the review machine were completely reliable and noticeably quieter than single-sided drives. Each disk holds 338 kbytes formatted (700k unformatted) in G8 sectors at 512 bytes/sector — which makes the reading of normal 128 bytes/sector disks rather complicated. Average access time is 250 milliseconds (35ms track-to-track) with a transfer rate of 250 kbits/second from 300 rpm drives.

The 240 V power supply is fitted here. Bad placement of the transformers can cause a screen waver but the review machine's transformers were all fitted behind the drives and caused no discernible interference.

Software

The system boots in with "64K SUPERBRAIN QUAD DENSITY DOS VER 3.0 FOR CP/M 2.2" at the top of the screen. Along with CP/M 2.2, the review machine was supplied with both the compiler and interpreter for Microsoft's MBasic 5.0, Digital Research's new PL/1 compiler, SORCIM Pascal/M and Wordstar. SuperBrain's operating system contains several utility programs to deal with, for instance, the conversion of 128 bytes/sector disks to the 512 bytes/sector required by the latest DOS system. I never actually succeeded in getting this one to work — the program always failed with a 'disk not ready' message, so it can't be as straightforward as it seems and certainly more complex than on some other machines I have used. The two serial ports, on the other hand, can be easily re-configured by means of the program CONFIGUR, whereby the baud rate, parity etc. can be changed simply by selecting the required value from a menu.

PIP contains two functions, INP and OUT, which, according to the manual, allow the SuperBrain to be connected (and to behave as a dumb terminal) to another computer or to permit the transfer of ASCII or Hex files between the two machines. After some hours of struggling to make the connection with an LSI 11 according to the manual, I discovered that an extra signal was



A trepanned SuperBrain — note the heavy shielding between CRT and disk drives.

required to make contact with the SuperBrain.

Once that was accomplished I had no trouble connecting up and transferring files from the LSI 11 to the SuperBrain via INP.

There is a size limitation of 25k per file and this must contain all the dialogue between the keyboard and the remote processor, as well as the file data itself. It is, of course, necessary to edit this dialogue out to return the file to its original state. I was also able to use the SuperBrain as a dumb terminal via INP, although the SuperBrain was not as dumb as I would have liked. The connection could be broken for instance by rapidly striking one or more of the keys, in which case PIP was liable to abort. Fortunately, upon re-connection, everything was usually all right. Another way to break the connection was to attempt to list rubbish (e.g. a binary file) on the screen in which case PIP again would abort, but the LSI would continue listing out to nothing.

OUT should have enabled the transfer of files from the SuperBrain to the

other machine. After failing to get this to work, I was informed that this version of OUT contained a bug, the patch for which was still on its way from America.

The BIOS portion of DOS is provided as a source program to simplify modifications to the peripheral drivers.

The latest Wordstar contains the nice feature of displaying a directory listing just before you load the file in, so that forgetful operators can remind themselves of the precise name of the file they require without having to return to operating system level. You can also switch disks (the 'logged — in disk') without leaving Wordstar — so that you could keep all the text files on one disk, and Wordstar itself, write-protected if necessary, on another. Long sessions could ensue without ever leaving Wordstar or having to re-set all those editing parameters — the package becomes more like a full operating system every time I use it!

Pascal/M is a fairly large Pascal compiler requiring at least 56k of memory

Technical Data

CPU:	2 Z80A 4 MHz
Memory:	64k dynamic RAM, 1k static RAM, 2k ROM
Keyboard:	76 keys, full ASCII
Screen:	12" white on grey
Cassette:	N/A
Disks:	2 drives, 5¼" double density, double sided
Printer:	N/A
Bus:	Z80A 40-pin data bus
Ports:	2 serial
System Software:	CP/M
Languages:	Basic 80, PL1, Pascal/M, 8080 assembler



and compiling to pseudo-machine code (p-code). This implementation is 'extended' using UCSD and the definition of ADA for guidance. Such extensions include SEGMENTation, STRINGS and string functions, untyped files, an extended character set for identifier names, direct access files and a random number generator.

Digital Research's PL/1-80 is the first implementation of PL/1 on a micro that I've seen. It is based on the ANSI General Purpose Subset (Subset G). The subset G does not include the following attributes or functions: DEFINED, FLOAT, DECIMAL, LIKE, PICTURE, FILE (allowed only in an OPEN statement), asterisk extents, dynamic arrays, ATANH, DATE, STRING, and TIME VALID; while the following features have been added: %REPLACE, READ and WRITE for variable length ASCII records, GET EDIT extended to full record input in a format, intrinsic functions ASCII and RANK. In order to run a PL/1 program it must first be compiled using a three-pass compiler which produces relocatable machine code, and then

linked with the runtime subroutine library before it can be executed.

Potential

With its neat, integral appearance and CP/M operating system, the SuperBrain was designed to fit into a commercial environment. Other than Wordstar, I was not supplied with any application software on the review machine although plenty of CP/M software is available. I was lent a manual for Data Star, a filing system which permits the entry of information via forms on the screen, with range and format checking, into a file with multiple keys. According to its documentation, Data Star allows a user to select records satisfying given criteria and can be used in conjunction with programs in most languages.

Either the second serial port or the Centronics compatible connector can be used to interface a printer to the SuperBrain and that about exhausts the physical enhancements possible on the single stand-alone machine. Although

this is not necessarily a limiting factor — 64k RAM and 680k storage constitute a pretty respectable micro-offering in the commercial environment — Intertec's plans to provide a link-up capability through the Compustar and the machine's ability to behave like a terminal of arbitrary intelligence, make the SuperBrain a reasonable prospect for any multi-user or distributed processing application. I particularly liked the fact that the multi-user system allows for the sharing of expensive peripherals without overloading either the processors or the data-bus — a mistake which some of Intertec's competitors have made to their cost.

As an intelligent terminal in a distributed processing system, the SuperBrain certainly has the right looks and it is compact, about the same size and shape as a fairly standard VDU. Unfortunately, the review machine did not have all the software necessary to turn it into a robust, truly intelligent terminal.

Looking at the machine from an educational viewpoint, it has some limitations. I suspect that the case

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Memory map

BIOS	FFFFH
BDOS	FA00H
CCP	EC00H
	E400H
USER	
AREA	
CP/M	0200H

Bench marks

BM1	1.56
BM2	5.25
BM3	14.01
BM4	13.91
BM5	14.77
BM6	26.26
EM7	43.24
BM8	5.56

Disk Tests

D1	0.95
D2	16.41
D3	26.35
D4	14.41
D5	13.02
All times in seconds	

would rapidly become fairly shabby after a period of being humped from room to room and bashed about in 'normal' school use. Although the screen is memory-mapped and the user can therefore direct characters to any desired screen-position, there is no graphics capability as such, and there appears to be no obvious method of adding this feature — which is so desirable for the teaching of programming, for Computer Aided Learning and for good computer games. The SuperBrain is also a very unlikely laboratory tool as the only possibilities for interfacing are through the two serial and single (optional) Centronics parallel port.

Expansion

The review machine was fully expanded — a minimal SuperBrain has 32k RAM and two single-sided, double-density drives (340k total). Intertec Data Systems showed two expansion products at the NCC. The first was the Z80A to S100 bus converter which will allow a single S100 card (for example a hard disk controller) to be installed in the case and thus be built into the system. The second way to expand the SuperBrain is to turn it into an intelligent terminal operating in a multi-user system. Intertube has announced the Compustar multiuser system in which up to 15 SuperBrains can be connected to a master processor which controls access to hard disks and printers, etc. The drives will be Century Data Systems 20 Mbyte Winchester, or CDC 32 Mbyte or 96 Mbyte cartridges. According to the sales brochures, up to four Compustars can be connected



Neat and simple. . . rear view of the SuperBrain.

to the same cartridge drives. We await developments with interest. . .

Documentation

The review machine came with a large SuperBrain user's manual, plus six others. The user's manual looks like a mail-order catalogue, complete with thumb-index. After the first few pages of advertising, a table of contents is reached wherein are listed the names of all the standard software manuals available within a CP/M system with Basic 80, plus several sections devoted to the SuperBrain. I found this format much easier to use than the dozen or so independent manuals in a ring binder which one has come to expect from the (better) firms. I was not that impressed however by those sections produced by Intertec themselves. Firstly, they document an ideal system rather than the system that actually exists, and secondly, they tend to gloss over the details which might pin the manual down to one particular SuperBrain specification.

The other manuals provided were for Pascal/M, Wordstar, Data Star and PL/1 (three manuals). The Pascal/M manual has a table of contents, is paginated, indexed and clearly written. It is not a Pascal manual however (since Jensen and Wirth have written one which every Pascal user presumably possesses), but rather a description of how to use Pascal/M in particular, and how it differs from 'standard' Pascal. The —Star manuals are comprehensive but are rather turgid with fairly heavy-handed descriptions of the various processes and procedures — a shame since the programs are really very good.

The three PL/1-80 manuals comprise a language manual, Link-80 operator's guide and an applications guide. They are all paginated and have detailed tables of contents. All are in the same, concise, in-house style as the CP/M manuals. The language manual defines the language but without giving any examples. The Link-80 operator's guide has chapters on the linkage editor, relocatable macro assembler, the librarian, interfacing conventions and runtime subroutines. The applications guide is a tutorial book which provides the examples required to learn PL/1-80.

Conclusion

The SuperBrain is a compact, attractive 'single-box' computer, containing two Z80As and running under CP/M. It's competitively priced in relation to other mini-floppy, Z80A, CP/M systems. It doesn't contain a number of slots for a variety of different boards, so in that sense it hasn't the versatility of some of its competitors. However, its big plus is that it's an integral, stand-alone system.

It has some lovely touches, like the programmable serial I/O ports and the two-button re-set, and apart from some reservations regarding the software which controls the data transfer to another processor, I found the SuperBrain completely reliable, a pleasure to use, and very impressive with the new, quiet double-density, double-sided drives.

At a glance

FIRST IMPRESSIONS

Looks	****
Setting up	****
Ease of use	****

HIGH LEVEL LANGUAGES

Basic	****
Cobol	N/A
Fortran	N/A
Pascal	****
PL/1	****

PACKAGES

Business	N/A
Education	N/A
Home	N/A

PERFORMANCE

Processor	****
Cassette	N/A
Disk	****
Peripherals	N/A

EXPANSION

Memory	*
Cassettes	N/A
Disks	N/A
Bus	**

COMPATIBILITY

Hardware	**
Software	****

DOCUMENTATION

--	-----

VALUE FOR MONEY

--	------

NOT DESIGNED FOR MUSIC

THE TROUBLE WITH TRS-80's

We like Tandy's home computer. At 16K Level II stage it is a reliable and reasonably priced entry to the magic of computers. But that cassette!

Tandy's optional "glitch kit" makes it fairly dependable, but it's still slow, requires knob twiddling for volume level and button pushing for operation.

Enough to put you off computers!

TANDY'S ANSWER

Of course Tandy has an answer, add an expansion interface and a small disk drive.

Ask the price!

ASP's ANSWER

Now we have an alternative, and it's not just a matter of offering a non-standard small disk drive a little cheaper than Tandy with the attendant risk if it doesn't work.

STRINGY FLOPPY

The solution is a compact high-speed tape transport system entirely under the control of the computer - designed for data - not music. It's called STRINGY FLOPPY.

There are no controls to fiddle with, just one light indicating the drive is in operation and another indicating that data is being written onto wafer. It simply plugs into the back of the Tandy keyboard unit. Or with an optional adaptor into the System 80 Computer sold by Dick Smith.

WAFERS - NOT CASSETTES

Unlike the cassette recorder that comes with the Tandy, STRINGY FLOPPY uses specially designed "wafers" about the size of a credit card and 5 mm. thick. These contain an endless loop of special chromium dioxide tape ranging in length from 1.6 to 23 metres. Their low mass means they operate reliably at high speed.

Removal of a reflective label protects them against accidental overwriting of data.

Their special tape and the digital recording method used means you don't lose data.

RELIABLE RECORDING

STRINGY FLOPPY uses a true digital recording technique like floppy disks, not fluctuating audio tone. The result - RELIABILITY.

The system was designed for computers - not designed for music.

NO MAINTENANCE DRIVE UNIT

The STRINGY FLOPPY wafer has the pressure roller for the capstan built in. So the capstan and the record head can be fixed in the die-cast aluminium drive. No adjustments required. The wafer just slides into the drive and "clicks" home. No other mechanical motion is required. And because wafers contain endless loops, the tape always travels in the same direction.

There is no need for a rewind capability.

Simplicity means reliability.

INTEGRATION TO THE TANDY

All this would be useless if STRINGY FLOPPY wasn't easy to use. So its operating system is in a permanent memory chip (ROM) in the drive unit.

Using the SYSTEM command it becomes part of the Tandy.

14K of ROM instead of just 12K. Commands allow you to initialize wafers (prove their integrity), load or save up to 99 files on a wafer on up to 8 STRINGY FLOPPY drives connected to the Tandy.

Programs can be in BASIC or machine language. Loading the 1K DATA I/O program from wafer adds additional commands to store and retrieve data rather than programs.

SPECIAL BONUS

Those who know their Tandy's well will know all about the dreaded keybounce! Well, STRINGY FLOPPY's ROM contains a keybounce fix routine. Nice?

RECORDING SPEED DENSITY

STRINGY FLOPPY records at 7200 baud (700 characters per second), 14 times faster than Tandy's cassette on a Level II machine. Tape speed is 25 cms. per second, so you can calculate access and loading times. If you "hot-up" your Tandy by increasing the clock speed you will

get a proportionate increase in data density and therefore wafer capacity.

Even on a standard Tandy you can fit up to 64K on a 23 metre wafer.

PROGRAMMING

With STRINGY FLOPPY you can create programs which chain under the control of your computer. The pressure on memory diminishes. ASP has programs such as its word processor and a data base manager which can demonstrate the possibilities for clever creative programming.

THE CATCH

OK, the bottom line. STRINGY FLOPPY complete with operating system, plug pack power supply, DATA I/O program is \$350.00 including Sales Tax. Add \$5.00 for freight within Australia.

And we'll include a box of 10 mixed length wafers (normally \$35.00) and a 2 for 1 bus extender (normally \$20.00) in the price.

And a six month limited warranty.

And a year's subscription to our STRINGY FLOPPY Newsletter.

AND if you're not satisfied with STRINGY FLOPPY, return it within two weeks for a courteous refund (this applies only to non-Bankcard purchases).

So maybe there wasn't a catch.

BANKCARD orders must quote full Bankcard number, Expiry Date and be signed.

Versions for other computers are available.



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NEWCOMERS-START HERE

What follows is a brief guide for the microcomputing novice. It has been designed for quick reference — with all the key words in bold type; of course if you're feeling adventurous, you're welcome to read it right through. Whichever way, we trust you will find it helpful. Happy Microcomputing!

Welcome to the confusing world of the microcomputer. First of all, don't be fooled; there's nothing complicated about this business, it's just that we're surrounded by an immense amount of necessary jargon. Imagine if we had to continually say "numbering system with a radix of sixteen in which the letters A to F represent the values 10 to 15" when instead we can simply say "hex". No doubt soon many of the words and phrases we are about to explain will eventually fall into common English usage. Until that time, APC will be publishing this guide — every month. We'll start by considering a microcomputer's functions and then examine the physical components necessary to implement these functions.

The microcomputer is capable of receiving information, processing it, storing the results or sending them somewhere else. All this information is called data and it comprises numbers, letters and special symbols which can be read by humans. Although the data are (yes, it's plural) accepted and output by the computer in 'human' form, inside it's a different story — they must be held in the form of an electronic code. This code is called binary — a system of numbering which uses only 0s and 1s. Thus in most micros each character, number or symbol is represented by eight binary digits or bits as they are called, ranging from 00000000 to 11111111.

To simplify communication between computers, several standard coding systems exist, the most common being ASCII (American Standard Code for Information Interchange). As an example of this standard, the number five is represented as 00110101 — complicated for humans, but easy for the computer! This collection of eight bits is called a byte and computer freaks who spend a lot of time messing around with bits and bytes use a half-way human representation called hex. The hex equivalent of a byte is obtained by giving each half a single character code (0–9, A–F): 0=0000, 1=0001, 2=0010, 3=0011, 4=0100, 5=0101, E=1110 and F=1111. Our example of 5 is therefore 35 in hex. This makes it easier for humans to handle complicated collections of 0s and 1s. The machine detects these 0s and 1s by recognising different voltage levels.

The computer processes data by reshuffling, per-

forming arithmetic on, or by comparing them with other data. It's the latter function that gives a computer its apparent 'intelligence' — the ability to make decisions and to act upon them. It has to be given a set of rules in order to do this and, once again, these rules are stored in memory as bytes. The rules are called programs and while they can be input in binary or hex (machine code programming), the usual method is to have a special program which translates English or near-English into machine code. This speeds programming considerably; the nearer the programming language is to English, the faster the programming time. On the other hand, program execution speed tends to be slower.

The most common microcomputer language is Basic. Program instructions are typed in at the keyboard, to be coded and stored in the computer's memory. To run such a program the computer uses an interpreter which picks up each English-type instruction, translates it into machine code and then feeds it into the processor for execution. It has to do this each time the same instruction has to be executed.

Two strange words you will hear in connection with Basic are PEEK and POKE. They give the programmer access to the memory of the machine. It's possible to read (PEEK) the contents of a byte in the computer and to modify a byte (POKE).

Moving on to hardware, this means the physical components of a computer system as opposed to software — the programs needed to make the system work.

At the heart of a microcomputer system is the central processing unit (CPU), a single microprocessor chip with supporting devices such as buffers, which 'amplify' the CPU's signals for use by other components in the system. The packaged chips are either soldered directly to a printed circuit board (PCB) or are mounted in sockets.

In some microcomputers, the entire system is mounted on a single, large, PCB; in others a bus system is used, comprising a long PCB holding a number of interconnected sockets. Plugged into these are several smaller PCBs, each with a specific function — for instance, one card would hold the CPU and its support chips. The most widely-used bus system is called the S100.

The CPU needs memory in which to keep programs

and data. Microcomputers generally have two types of memory, RAM (Random Access Memory) and ROM (Read Only Memory). The CPU can read information stored in RAM — and also put information into RAM. Two types of RAM exist — static and dynamic; all you really need know is that dynamic RAM uses less power and is less expensive than static, but it requires additional, complex, circuitry to make it work. Both types of RAM lose their contents when power is switched off, whereas ROM retains its contents permanently. Not surprisingly, manufacturers often store interpreters and the like in ROM. The CPU can only read the ROM's contents and cannot alter them in any way. You can buy special ROMs called PROMs (Programmable ROMs) and EPROMs (Erasable PROMs) which can be programmed using a special device; EPROMs can be erased using ultra-violet light.

Because RAM loses its contents when power is switched off, cassettes and floppy disks are used to save programs and data for later use. Audio-type tape recorders are often used by converting data to a series of audio tones and recording them; later the computer can listen to these same tones and re-convert them into data. Various methods are used for this, so a cassette recorded by one make of computer won't necessarily work on another make. It takes a long time to record and play back information and it's difficult to locate one specific item among a whole mass of information on a cassette; therefore, to overcome these problems, floppy disks are used on more sophisticated systems.

A floppy disk is made of thin plastic, coated with a magnetic recording surface rather like that used on tape. The disk, in its protective envelope, is placed in a disk drive which rotates it and moves a read/write head across the disk's surface. The disk is divided into concentric rings called tracks, each of which is in turn subdivided into sectors. Using a program called a disk operating system, the computer keeps track of exactly where information is on the disk and it can get to any item of data by moving the head to the appropriate track and then waiting for the right sector to come round. Two methods are used to tell the computer where on a track each sector starts: soft sectoring

where special signals are recorded on the surface and hard sectoring where holes are punched through the disk around the central hole, one per sector.

Half-way between cassettes and disks is the stringy floppy — a miniature continuous loop tape cartridge, faster than a cassette but cheaper than a disk system. Hard disk systems are also available for microcomputers; they store more information than floppy disks, are more reliable and information can be transferred to and from them much more quickly.

You, the user, must be able to communicate with the computer and the generally accepted minimum for this is the visual display unit (VDU), which looks like a TV screen with a typewriter-style keyboard; sometimes these are built into the system, sometimes they're separate. If you want a written record (hard copy) of the computer's output, you'll need a printer.

The computer can send out and receive information in two forms — parallel and serial. Parallel input/output (I/O) requires a series of wires to connect the computer to another device, such as a printer, and it sends out data a byte at a time, with a separate wire carrying each bit. Serial I/O involves sending data one bit at a time along a single piece of wire, with extra bits added to tell the receiving device when a byte is about to start and when it has finished. The speed that data is transmitted is referred to as the baud rate and, very roughly, the baud rate divided by 10 equals the number of bytes being sent per second.

To ensure that both receiver and transmitter link up without any electrical horrors, standards exist for serial interfaces; the most common is RS232 (or V24) while, for parallel interfaces to printers, the Centronics standard is popular.

Finally, a modem connects a computer, via a serial interface, to the telephone system allowing two computers with modems to exchange information. A modem must be wired into the telephone system and you need Telecom's permission; instead you could use an acoustic coupler, which has two obscene-looking rubber cups into which the handset fits, and which has no electrical connection with the phone system — Telecom isn't so uppity about the use of these.

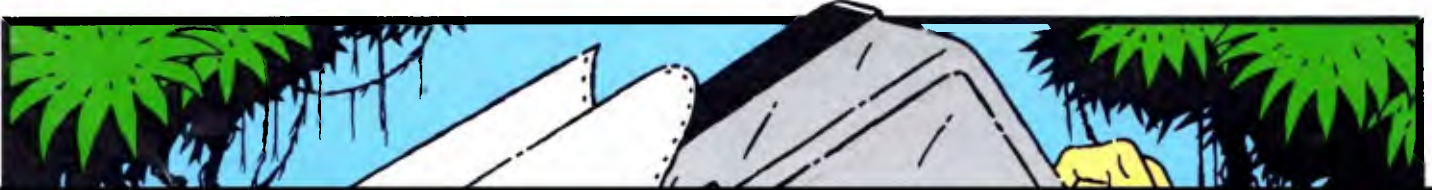
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A 'Jane's Guide' to all the options

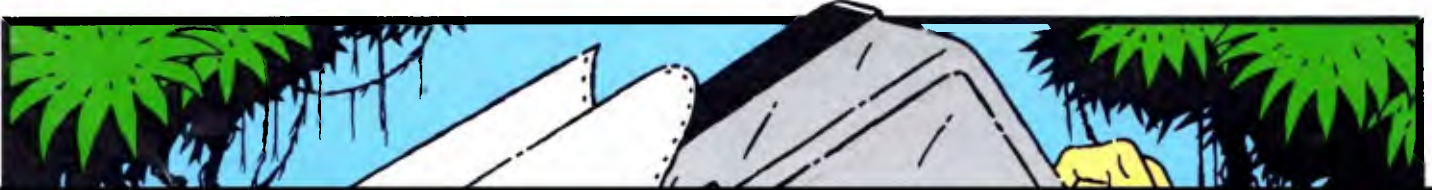
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ZX80

8K

BASIC ROM

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Month by month, every effort will be made to keep In Store up-to-date and accurate.

And that means APC will always be happy to hear from its readers of any errors, and additions that seem worthy of inclusion.

LIST OF ABBREVIATIONS

A - Assembler	Ex - Extended	M/A - Macroassembler	res - Resolution
A/D - Analog to Digital	F/D - Floppy Disc	N/A - Not Available	S - Software
B/W - Black and White	H - Hardware	N/P - Numeric Pad	S/P - Serial Port
C - Cassette	I - Introductory	O/S - Operating System	T/E - Text Editor
cps - Characters per second	I/O - Input / Output	P/P - Parallel Port	U - Utility
Doc - Documentation	int - Interface	RAM - Random Access Memory	VDU - Video Display Unit
E - Extensive	K/B - Keyboard	ROM - Read Only Memory	

All prices shown are exclusive of sales tax, except where indicated by an asterisk.

Software items listed in *italics* are not included in the basic price of the equipment.

Name of Machine	Main Distributor & Phone No	Hardware	Software	Doc	Price	Comments
Apple II plus	—	16-48K RAM: 6502: colour VDU int.: 81/O slots: games paddles: option 5¼" F/D (116K) and 11 MB disc	O/S: BASIC: <i>Pascal</i> : games	E	\$1395	280x192 high res colour graphics: Applesoft BASIC in 12K ROM
Century	Abacus Computer Store (03) 429 5844	C100, 48-64K RAM: Z80: 12" VDU: 2x5¼" F/D (2x143K): 112 cps printer: RS232 port: S100 bus: C200 includes 2x F/D (2x315K): hard disc: 4xRS232: 2xP/P	<i>COBOL: FORTRAN: BASIC</i>	I	C100—\$4950: C200—\$5400	Also available: C300
Challenger IP	Systems Automation (02) 439 6477	4-32K RAM: 6502: C int: 24x32 VDU int: RS232 port: option - dual 5¼" F/D (140K)	O/S: BASIC: A: games	I	\$448	8K microsoft BASIC in ROM: expansion board available
Challenger 4	Systems Automation (02) 439 6477	8-48K RAM: 6502: colour 32x64 VDU int: RS232 port: P/P: option - 6502C microprocessor; dual 5¼" F/D (140K)	BASIC: <i>Pascal</i>	I	\$871	BASIC in 8K ROM
Compucolor II	Anderson Digital Equipment (03) 543 2077	8-32K RAM: 8086: 13", 32x64 8 colour VDU: single 5¼" F/D (51K): RS232 port	ExBASIC(ROM):A	I	\$2095	16K model, \$2395: 32K \$2695: maintenance manual available
Cromemco System 2, System Z2H, System 3	—	64-512K RAM: Z80A: System 2, dual 5¼" F/D (346K): System Z2H, also Winchester disc (11MB): System 3, 8" dual 1MB: S/P: P/P	CDOS: <i>BASIC: COBOL: FORTRAN: M/A: ExBASIC: Structured BASIC</i>	E	System2 \$3990 System Z2H \$9650 System 3 \$6750	All Systems expandable to multi user (2-7 users) \$2880-\$8825
Exidy Sorcerer Model II	Dick Smith Electronics (02)888 3200	8-48K RAM: Z80: 30x64 VDU int.: RS232 Port: P/P: S100 bus:extra C int.	O/S: ExBASIC (ROM): <i>M/DOS: CP/M</i>	I	\$1295*	High res graphics capability: 16K version \$1395*: 32K version \$1525*: 48K version \$1655*: User programmable character set
HP-85	Hewlett Packard Australia (03)89 6351	16-32K RAM: N/A: 5", 16x32 B/W VDU: C(200K): 64 cps printer: RS232 port: 4 x P/P	BASIC	S	\$3550	Full dot matrix graphics: N/P: compact portable unit
IPS-100	Microprocessor Applications (03) 754 5108	32-896K RAM: 8085: 2 RS232 ports: S100 bus: dual 5¼" F/D (630K)	O/S: Ex BASIC: Ed: A: <i>CP/M: CBASIC: FORTRAN: COBOL</i>	E	\$3750	
Industrial Micro Systems	S.I. Micro-computer Products P/L (02) 231 4091	32-64KRAM Z80A 5¼" F/D (170K) 2 x SP Optional to 100 M VDU \$1250. P/P 8" F/D ditto but to 2400K	O/S CP/M BASIC Cobol Fortran Pascal	E	\$2747 \$4565	Multi terminal capability Interrupt driven 80 char x 24 lines Ditto x Hard Disk 24M up option.
Microengine	Daneva Control (03)598 9207 Abacus Computer Store for complete system (03) 429 5844	64K RAM: MCP 1600: 2 x RS232 ports: 2xP/P: Options - dual 5¼" F/D (Single or dble density); 8" F/D (single or dble density)	BASIC: Pascal: File Manager: U	E	\$2995	Also available as board
National Panasonic JD800	The Computer Company (02) 436 1733	64K RAM; 2-4K PROM; 8085A; 3 RS232C ports; S/P &/or P/P; 2 x 8" F/D (500K); 1920 ch. green phosphor VDU;	PanaBasic, Interpreter, Microsoft Basic, Fortran, Cobol & Assembler	E	\$9290	PF 1-15 & PE 1-6 function keys on all models
National Panasonic JD840	The Computer Company (02) 436 1733	64K RAM; 2-4K PROM; 8085A; 3 RS232C ports; 2 x 5¼" F/D (2.2 Mb) 1920 ch. green phosphor VDU;	Panabasic, Interpreter, Microsoft Basic Fortran, Cobol & Assembler	E	\$10725	

IN STORE

Name of Machine	Main Distributor & Phone No	Hardware	Software	Doc	Price	Comments
National Panasonic JD700	The Computer Company (02) 436 1733	32-64K RAM; 2-4K PROM; 8085A; 3 RS232 ports; 2 x 5 1/4" (140K); 1920 ch. green phosphor VDU;	Panabasic, Interpreter, Microsoft Basic Fortran, Cobol & Assembler	E	\$7850	
National Panasonic JD740	The Computer Company (02) 436 1733	64K RAM; 2-4K PROM; 8085A; 3 RS232 ports; 2 x 5 1/4" F/D (560K) 1920 ch. green phosphor VDU;	Panabasic, Interpreter, Microsoft Basic Fortran, Cobol & Assembler	E	\$8550	Price depends on systems configuration
North Star Horizon	Melbourne Byte Shop (03) 568 4022 S.I. Micro-computer Products (02) 231 4091	32-64K RAM: Z80A: 5 1/4" F/D (170K); 2xS/P; 1P/P: optional - VDU (\$1350); Quad density F/D	DOS: BASIC: COBOL: FORTRAN: Pascal: CP/M: M/A	E	\$2695	
Pet 2001	Hanimex (02) 938 0400	8-32K RAM: 6502: C: 9" 25x40 B/W VDU: extra C Int: IEEE488 port	O/S: BASIC: A	I	8K\$1199 16K\$1859 32K\$2249	Options - dual 5 1/4" F/D (353K), \$2329: \$109 for disc operating ROM
Sinclair ZX80	Sinclair Equipment (Australasia) Pty. Ltd. (03) 861 6224	1-16K RAM; 780-1; C int: T.V. int: full K/B 44 pin expansion port	4K BASIC in ROM	I	\$295*	CPU is NEC 3.25 MHz version of Z80A
Sord M100 ACE III	Alliance Digital Corporation (02) 436 1600 Abacus (03) 429 5844	48K RAM: Z80: 24x64, 12" VDU: RS232 ports: 2x5 1/4" F/D (2x143K): S100 bus: 2 octave speaker: A/D Conv.: option-8 colour graphic controller (\$1450)	O/S: ExBASIC FORTRAN	I	\$4500	M100 ACE IV - 8 colour graphics controller incl.
Sord M223	Alliance Digital Corporation (02) 436 1600 Abacus (03) 429 5844	64K RAM: Z80: 12" 24x80 VDU: 2xRS232 port: S100 bus: 5 1/4" F/D (350K)	O/S: ExBASIC: FORTRAN: COBOL	I	\$7500	
System 80	Dick Smith Electronics (02) 888 3200	16K RAM; Z80; 500 bps C; 32 x 64 TV int.; 1 P/P	BASIC: M/A; Fortran	I	\$615*	
TRS-80 Level 1	Tandy Electronics (02) 638 6633	4-16K RAM: Z80: C: 12" 16x64 B/W VDU	BASIC: Games: A	I	\$699*	BASIC in 4K ROM: upgradable to Level 2
TRS-80 Level 2	Tandy Electronics (02) 638 6633	4-48K RAM: Z80: C: 12", 16x64 B/W VDU: RS232 port: P/P	BASIC: M/A: FORTRAN: COBOL		\$879*	16K machine includes N/P: 4-16K upgrade \$320*: (\$250* without N/P): max. config. \$1169*: option - single 5 1/4" F/D (78K), (max of 4)
Vector Graphics System B	AJ & JW Dicker (02) 524 5639	64K RAM: Z80: Dual 5 1/4" F/D (630K): 12", 24x80 B/W VDU: S/P: 2xP/P	DOS: BASIC: A: CP/M: Ed	E	\$6350	Graphics and numeric pad.
Versatile 4	Microprocessor Applications (03) 754 5108	32-56K RAM: 8085: 9", 24x80 B/W VDU: dual 5 1/4" F/D (630K): S100 bus: 2xRS232	MBASIC: MDOS (including T/E and A): Version 4 MDOS AND BASIC: CP/M	E	\$5692	

SINGLE BOARDS

Acorn	Cottage Computers (03) 481 1975	1-8K RAM: 6502: EPROM socket: Hex K/B: C int: 8 digit LED display: up to 16 ports: options - Euro-card 64 way connector; VDU card; Full K/B card	1/2K monitor: BASIC	S&H	System I \$285: System II \$1224: System III (incl. a 5 1/4" F/D), \$2763	Universal interface card available.
Aim 65	Dwell Pty Ltd (02) 487 3111	1-4K RAM: 6502: 8K ROM: full K/B: 20 character LED display: 20 character thermal printer: Cx2 int: 1 P/P	8K monitor in ROM: A: BASIC	E	\$525*	Case available \$75*
SBC100	Microtrix (03) 718 2581	1K RAM: Z80: 8K ROM: S100 bus: 1S/P: 1P/P	1K monitor: DOS in ROM	E	\$299	Also available assembled \$374
Superboard	Systems Automation (02) 439 6477	4-32K RAM: 6502: 10K ROM: full K/B: 24x32 VDU Int: C int: options - RS232; dual 5 1/4" F/D (140K)	BASIC: games	I	\$360	BASIC in 8K ROM

Animistics

I read with fascination Neil Frude's article 'Animistics' (July APC).

While we are running barefoot through the outer fringes of technology, how about a replacement of the blow-up female simulcra advertised in Playboy and such like. The blow-up doll market would collapse like a pricked balloon under the onslaught of a computer controlled responsive 'Randy Raquel'. Slot-in ROM pacs can cater for whatever perversion is your bag of beans and vocabulary pre-programmed from murderers to howls of appreciation.

You may not like the idea but to extend Frude's criteria of probability, 'there is money here, so no doubt they will be built'. No doubt readers will view it as prostitution of technology but this will not stop it (remember $E = MC^2$).

This is not a new concept. Anyone remember a film called the Stetford Wives? Anyhow whatever the final outcome I am sure that it will give a new nuance to the phrase 'dolly birds'.

J. D. Swift.

Cheap screen

If there's one thing the average computer will give you it's a headache. Not the programming variety, but a genuine headache induced by peering for hours at a harsh white screen only inches from your eyes.

Solutions include sunglasses (which make the reading of magazines etc. rather difficult) and larger monitors further away.

A simpler and inexpensive solution is to trot down to your local garage and purchase a length of green plastic sheeting which can be cut to size and stuck onto your monitor (this sheeting is otherwise referred to as an anti-glare strip and is used on windscreens).

Easy on the eyes and not much strain on the pocket either.

F. G. Sturges.

No Worries

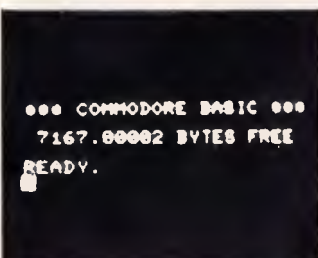
A Mr Griffiths informs me that my concern expressed in last month's issue regarding the safety of connecting six power cords (required for operation of a Tandy business system) to one power outlet is unwarranted. He calculates

a total of 500 watts are drawn — half that of a single bar radiator.

So you can safely eliminate the computer system from your short list of culprits when the fuses blow.

Dr Jon Patrick
Pahran C.A.E.

PET pranks



I thought you might like to see the enclosed photo of an 8k PET screen after power-on. It seems to prove that even micros have a sense of humour or perhaps it had just had a good night's rest previously. Anyway, I can deny it represents my efforts at getting a small foothold in the add-on memory business.

R D Eberst.

Ohio quickie

In response to your call for short programs, I'd like to offer the following for an Ohio Superboard:

```
1 S=5 3692+Y:
V=PEEK(S)=49: POKE
S,49+V: Y=V-V*Y:
GOTO 1
```

Note that $V=PEEK(S)=49$ is not an error.

P. Smith.

We haven't tries this and we've no idea what it does, so you're on your own!
Ed.

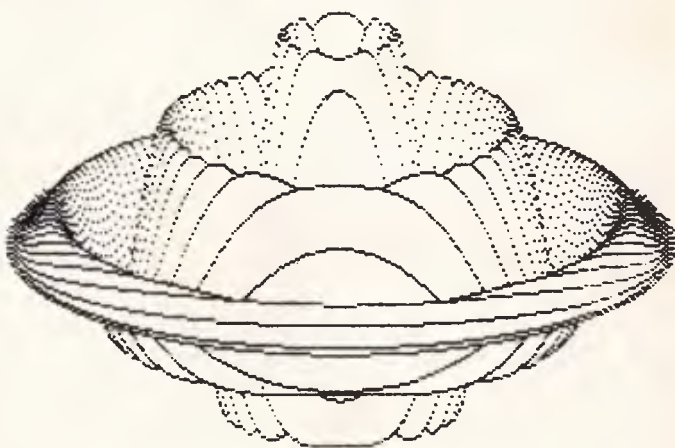
3D improvement

I was interested in Malcolm Banthorpe's article on 3-D plotting in your July issue. With slight modification, his program is very suitable for use on the HP85. It is possible, by adding a couple of lines, to show also the visible

underside of the surfaces and this I believe improves the picture. Enclosed, with program listing, is an HP85 plot of a variant of his second figure, with visible underside shown.

Professor R H Macmillan.

```
• 10 SCALE 0.255.0.191 •
• 20 X1=128 @ X2=X1*X1 @ Y1=96 @ •
  Y2=96 •
• 30 FOR X=0 TO X1 •
• 40 X4=X*X •
• 50 A=SQR(X2-X4) •
• 60 FOR I=-A TO A STEP 6 •
• 70 R=SQR(X4+I*I)/X1 •
• 80 F=(R-1)*COS(18*R) •
• 90 Y=I/3+F*Y2 •
• 95 IF I=-A THEN M=Y @ M1=Y @ Y= •
  Y1+Y @ GOTO 120 •
• 100 IF Y<=M THEN 160 •
• 110 M=Y @ Y=Y1+Y •
• 120 PENUP @ PLOT X1-X,Y •
• 130 PENUP @ PLOT X1+X,Y •
• 140 NEXT I @ NEXT X •
• 150 END •
• 160 IF Y>=M1 THEN 140 •
• 170 M1=Y @ Y=Y1+Y @ GOTO 120 •
```



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Canberra: 58 1811. Newcastle: 69 1625. Albury/Wodonga: (062) 2761. Barnawartha 129. N.Z. Wellington: 693 007.
Auckland: 87 6570. Christchurch: 79 6210. New Guinea Lae: 42 3924.

LEISURE LINES

Another good response - over 80 entrants - indicates that Puzzle 4 was not all that difficult (particularly for those of you with micros, programmable calculators, or use of OPCs - that's Other People's Computers).

In fact, I judge that the hardest part of the problem was actually fitting the answers onto a postcard, as requested; we even had one or two of the giant, home made variety.

The first correct entry selected out of the bag came from Elizabeth Bailey, Vermont; she will be receiving through the post, the promised bottle of Great Western Champagne. Her answers (which are not unique - in fact there is an infinite number of answers to each part of the question) are as follows:-

(a=2) 105263157894736842

(a=3) 1034482758620689655172413793

(a=4) 102564

(a=5) 102040816326530612244897959183673469387755

(a=6) 1016949152542372881355932203389830508474576271186440677966

(a=7) 1014492753623188405797

(a=8) 1012658227848

(a=9) 10112359550561797752808988764044943820224719

(I just hope the typesetter isn't too full of party spirit when this page is being set!)

THE QUICKIE

Okay, eyes down for a quick one (a real 'cringer', I'm afraid).

Two Australian coins add up to 55 cents. One is NOT a 50 cent piece. What are they?

PRIZE FOR THIS MONTH

Prepare yourself for Summer . . . for this month's lucky person there'll be a super large beach towel (male or female variety - depending on the gender of the winner).

PRIZE PUZZLE

This month's problem shouldn't prove too difficult. Find the smallest perfect square that is also the average of two other perfect squares. In other words, find three perfect squares -

$$a^2, b^2 \text{ and } c^2 \text{ such that: } \frac{b^2}{2} = a^2 + c^2$$

By the way, for all you smart alecs out there . . . $a + b + c$.

Answers please on a postcard to: Puzzle No. 6, Australian Personal Computer, P.O. Box 115, Carlton, 3053. All solutions must arrive by November 28 the latest.

PROGRAMS

Lunar lander

by Tim Reeves

Graphically illustrated and a 'real time' simulation in Level II Basic, Lunar Lander will just fit into a 4K machine.

If the spacecraft descends too quickly for your liking, reduce the value of 'G' from its present 2.5 in line 50.

```

10 CLS:PRINT@288,"TO SET THROTTLE PRESS
AND RELEASE (0-9)"
20 PRINT@160,"GRAPHIC LUNAR LANDER"
30 PRINT@355,"REPEAT AS REQUIRED."
40 FOR X=1 TO 2000:NEXT X
50 YSCR=0:YPSN=0:CLS:THROT=0:VEL=1.5:G=2
.5:FUEL=100
60 TCNST=150:BURNRATE=.4:HULLWT=86:MCNST
=.01
90 FOR X=80 TO 127:SET(X,0):NEXT X
100 FOR X=80 TO 127:SET(X,15):NEXT X
110 FOR Y=0 TO 15:SET(80,Y):NEXT Y
120 FOR Y=0 TO 15:SET(127,Y):NEXT Y
130 PRINT@106,"THROTTLE":PRINT@170,"VEL
OCITY";
140 PRINT@234,"ALTITUDE":PRINT@298,"FUE
L %";
150 FOR X=0 TO 127:SET(X,47):NEXT X
160 FOR X=8 TO 23:SET(X,46):NEXT X
170 FOR X=54 TO 62:SET(X,46):NEXT X
180 FOR X=73 TO 127:SET(X,46):NEXT X
190 FOR X=11 TO 20:SET(X,45):NEXT X
200 FOR X=74 TO 100:SET(X,45):NEXT X
210 FOR X=76 TO 82:SET(X,44):NEXT X
220 SET(41,0):FOR X=40 TO 42:SET(X,1):NE
XT X
230 FOR X=40 TO 42:SET(X,2):NEXT X
240 FOR X=1 TO 2
250 T$=INKEY$:IF T$<>" " THEN THROT=VAL(T
$)
260 PRINT@115,THROT:NEXT X
270 FUEL=FUEL-(THROT*BURNRATE):IF FUEL>0
THEN 280ELSE THROT=0:FUEL=0
280 PRINT@307,"":PRINT@307,FUE
EL;
290 VEL=VEL+G-(THROT*TCNST/(HULLWT+FUEL
))
300 PRINT@179,"":PRINT@179,-V

```

```

EL;
310 YPSN=YPSN+VEL*MCNST
320 ALT=(43-YSCR)*1000:PRINT@243,"
":PRINT@243,ALT;
330 IF ABS(VEL)<5 GOTO 500
340 IF SGN(VEL)=1 GOSUB 440
350 IF YSCR=44 GOSUB 510
360 IF SGN(VEL)=-1 GOSUB 380
370 GOTO 240
380 IF YSCR=0 THEN SET(40,YSCR):SET(42,Y
SCR):SET(41,YSCR)
390 IF YSCR<1 GOTO 410
400 SET(40,YSCR):SET(41,YSCR-1):SET(42,Y
SCR)
410 IF YSCR<-2 THEN 430
420 RESET(40,YSCR+2):RESET(41,YSCR+2):RE
SET(42,YSCR+2)
430 YSCR=YSCR-1:RETURN
440 IF YSCR<-1 GOTO 470
450 IF YSCR=-1 THEN RESET(40,0):RESET(42
,0):GOTO 480
460 RESET(40,YSCR+1):RESET(41,YSCR):RESE
T(42,YSCR+1)
470 IF YSCR<-3 THEN 490
480 SET(40,YSCR+3):SET(41,YSCR+3):SET(42
,YSCR+3)
490 YSCR=YSCR+1:RETURN
500 FOR Z=1 TO 10:NEXT Z:GOTO 240
510 IF ABS(VEL)>30 PRINT@580,"PLEASE NOT
IFY NEXT OF KIN !!!":GOTO 550
520 IF ABS(VEL)>20 PRINT@580,"YOU BENT Y
OUR SPACESHIP !!!":GOTO 550
530 IF ABS(VEL)>10 PRINT@580,"PILOT SCHO
OL BY CORRESPONDENCE ?":GOTO 550
540 PRINT@580,"HAVE HE LANDED YET ?"
550 FOR X=700 TO 0 STEP -1:PRINT@130,X:
NEXT X
560 GOTO 50

```

PROGRAMS

PET Fighter Pilot

by E G Kemplen

Full instructions are in the listing.

```

100 REM***FIGHTER PILOT***
110 GOSUB740
120 PRINT"J"
130 T=1:SC=0:S=0
140 FORI=1TO25:POKE32788+40*I,66:NEXT
150 FORI=1TO40:POKE33287+I,64:POKE32768+I,160:NEXT
160 C=33308
170 POKEC,87
180 A=32868
190 B1=PEEK(A-2):B2=PEEK(A-1):B3=PEEK(A):B4=PEEK(A+1):B5=PEEK(A+2)
    B5=PEEK(A-40)
200 REM ***CHECKS SCREEN***
210 POKEA-2,70:POKEA-1,70:POKEA,90:POKEA+1,70:POKEA+2,70:POKEA-40,93
220 REM ***PUTS IN ENEMY PLANE***
230 FORN=1TO50:NEXT
240 PRINT"FUEL":30-INT((T1-T)/60)/10;" ",TAB(17)"SCORE":SC:TAB(30)"SHOTS":S
250 PRINT" ",TAB(11)"GALS"
260 GETX$:IFVAL(X$)<0THEN410
270 REM***CHECKS AIM***
280 IFPEEK(516)=1THENB7=PEEK(C):POKEC,42:FORI=1TO10:NEXT:POKEC,B7:S=S+1
290 IFPEEK(516)=1ANDPEEK(C)<87THENGOSUB520
300 IFS249THENPRINT"OUT OF AMMUNITION RUN LIKE HELL FOR HOME":GOTO680
310 IF(T1-T)/60<300THENPRINT"YOU'RE OUT OF FUEL, BREAK OFF":GOTO680
320 REM***CHECKS FOR FIRE***
330 N=-41+INT(RND(1)*3)+INT(RND(1)*3)*40
340 REM***ENEMY AVOIDING ACTION***
350 POKEA-2,B1:POKEA-1,B2:POKEA,B3:POKEA+1,B4:POKEA+2,B5:POKEA-40,B6
360 A=A+N+AIM
370 IFAC32811THENA=A+80
380 IFAC33724THENA=A-80
390 REM*CALCULATES NEW ENEMY POSITION*
400 GOTO190
410 IFVAL(X$)=1THENAIM=-39
420 IFVAL(X$)=2THENAIM=-40
430 IFVAL(X$)=3THENAIM=-41
440 IFVAL(X$)=4THENAIM=1
450 IFVAL(X$)=5THENAIM=0
460 IFVAL(X$)=6THENAIM=-1
470 IFVAL(X$)=7THENAIM=41
480 IFVAL(X$)=8THENAIM=40
490 IFVAL(X$)=9THENAIM=39
500 GOTO290
510 REM***AIM CORRECTION***
520 IFPEEK(C)=70ORPEEK(C)=93THENI=2
530 IFPEEK(C)=90THENI=5
540 SC=SC+I
550 FORI=1TO11
560 POKEC-39,42:POKEC-41,42:POKEC+41,42:POKEC+39,42
570 IFSC>49THEN640
580 FORJ=1TO25:NEXT
590 POKEC-39,32:POKEC-41,32:POKEC+41,32:POKEC+39,32
600 FORJ=1TO10:NEXT
610 NEXT
620 RETURN
630 REM***HIT SUBROUTINE***
640 T1=INT((T1-T)/60)
650 PRINT" ",TAB(17)"SCORE":SC
660 PRINT"ENEMY PLANE DESTROYED IN".T1,"SECONDS"
670 PRINT"USING":S,"ROUNDS OF AMMUNITION"
680 PRINT"TO PLAY AGAIN PRESS # SPACE #
690 PRINT"TO STOP PRESS # 0 #
700 GETV$:IFV$="0"THENSTOP
710 IFV$=" "THEN120
720 GOTO700
730 REM***FINAL DISPLAY***
740 PRINT"IT":TAB(7)"
750 PRINTTAB(7)"
760 PRINTTAB(7)"
770 PRINT:PRINT
780 PRINTTAB(11)"
790 PRINTTAB(11)"
800 PRINTTAB(11)"
810 PRINT:PRINT
820 XX$="YOU ARE THE PILOT OF A SFITFIRE":GOSUB1110
830 XX$="AHEAD OF YOU IS AN M.E.109":GOSUB1110
840 XX$="HE IS TAKING AVOIDING ACTION, AND YOU":GOSUB1110
850 XX$="MUST TRY TO SHOOT HIM DOWN":GOSUB1110
860 XX$="YOUR GUNS ARE FIRED BY PRESSING THE":GOSUB1110
870 XX$=" # SHIFT # KEY":GOSUB1110
880 PRINT:XX$="YOU CAN CHANGE YOUR AIM USING THE":GOSUB1110
890 XX$="NUMERIC KEYPAD AS FOLLOWS":GOSUB1110
900 PRINT:PRINT:XX$=" PRESS # SPACE # TO CONTINUE":GOSUB1110
910 GETV$:IFV$=" "THEN930
920 GOTO910
930 PRINT"IT":XX$="THE TOP ROW OF NUMBERS MAKE YOUR PLANE":GOSUB1110
940 XX$="CLIMB":GOSUB1110
950 XX$="THE BOTTOM ROW MAKE YOUR PLANE DIVE":GOSUB1110
960 XX$="THE LEFT ROW TURN YOU TO THE LEFT":GOSUB1110
970 XX$="THE RIGHT ROW TO THE RIGHT":GOSUB1110
980 XX$=" THE # 5 # KEY CENTRALISES YOUR CONTROLS":GOSUB1110
990 PRINT:XX$="7 8 9":GOSUB1110
1000 PRINT:XX$="4 5 6":GOSUB1110
1010 PRINT:XX$="1 2 3":GOSUB1110
1020 PRINT:XX$="YOU CANNOT ALTER COURSE WHILST FIRING":GOSUB1110
1030 XX$="YOUR GUNS":GOSUB1110
1040 PRINT:XX$="THE OBJECT OF THE GAME IS TO SCORE":GOSUB1110
1050 XX$="50 POINTS":GOSUB1110
1060 PRINT:XX$="A HIT ON THE WING OR TAIL SCORES 2":GOSUB1110
1070 XX$="A FUSELAGE HIT SCORES 5":GOSUB1110
1080 PRINT:XX$=" PRESS # SPACE # TO START THE GAME":GOSUB1110
1090 GETV$:IFV$=" "THENRETURN
1100 GOTO1090
1110 PRINTTAB((40-LEN(XX$))/2):XX$:RETURN

```

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PROGRAMS

```

10 PRINT "TAPE EDITOR."
20 CLEAR 5000: DIM T$(100): REM. CLEAR NOT NEEDED ON PET.
30 NC=0: DIM CM$(NC): W1$="": TOP$="": W2$="": END REACHED$=""
40 CM$(0)="B": CM$(1)="F": CM$(2)="L": CM$(3)="D"
50 CM$(4)="I": CM$(5)="R": CM$(6)="SAVE": CM$(7)="S": CM$(8)="T"
60 INPUT "EXISTING FILE (Y OR N) (L$=N) THEN 500"
70 IF L$(0)="Y" THEN 60
80 MX=1: GOSUB 10000
90 GOSUB 6000: IF EF THEN MX=MX-1: P=1: GOSUB 7000: GOTO 110
100 T$(MX)=L$: PRINT L$: MX=MX+1: GOTO 90
110 INPUT "C": C$
120 FOR X=0 TO NC: IF CM$(X)=C$ THEN 140
130 NEXT X: PRINT "BAD COMMAND": GOTO 110
140 ON X+1 GOSUB 170, 200, 230, 260, 310, 290, 340, 370, 400
150 GOTO 110
170 REM B-ACK
180 GOSUB 600: P=P-N: IF P=N THEN PRINT W1$: P=1
190 PRINT T$(P): RETURN
200 REM F-ORWARD
210 GOSUB 600: P=P+N: IF P=N THEN PRINT T$(P): RETURN
220 P=MX: PRINT W2$: RETURN
230 REM L-IST
240 GOSUB 600: FOR X=P TO P+N: IF X=MX THEN P=MX: PRINT W2$: RETURN
250 PRINT T$(X): NEXT X: P=P+N: RETURN
260 REM D-ELETE
265 IF MX(1) THEN PRINT "CAN'T DO ": RETURN
270 IF P=MX THEN T$(MX)="": MX=MX-1: P=MX: PRINT W2$: RETURN
280 FOR X=P TO MX-1: T$(X)=T$(X+1): NEXT X: PRINT T$(P): T$(MX)="": MX=MX-1: RETURN
290 REM R-ERASE CURRENT LINE

```

```

200 PRINT "BY": GOSUB 1000: T$(P)=L$: RETURN
210 REM. I-NSERT AFTER CURRENT LINE
220 FOR X=MX TO P+1 STEP -1: T$(X+1)=T$(X): NEXT X
230 REM MAKE NEXT 230
235 P=P+1: MX=MX+1: PRINT "INSERT": GOSUB 1000: T$(P)=L$: RETURN
240 REM. SAVE
250 GOSUB 9000: FOR X=1 TO MX: L$=T$(X): GOSUB 4000: PRINT L$: NEXT X
260 GOSUB 8000: PRINT "SAVE COMPLETED.": RETURN
270 REM. S-EARCH FOR
280 PRINT "SEARCH FOR": GOSUB 1000: F$=L$: IF F$="" THEN 380
290 IF P=MX THEN PRINT "CAN'T DO ": RETURN
400 FOR X=P+1 TO MX: L$=T$(X): GOSUB 3000
410 IF P$(0) THEN PRINT L$: P=X: RETURN
420 NEXT X: P=MX: PRINT W2$: RETURN
430 P=1: PRINT W1$: PRINT T$(1): RETURN: REM T-OP
500 PRINT "TYPE LINES, TERMINATED BY THE LINE: END": MX=1
510 GOSUB 1000: IF L$="END" THEN MX=MX-1: P=MX: GOTO 110
520 T$(MX)=L$: MX=MX+1: GOTO 510
600 INPUT "FOR": IN$: IF N$(0) THEN PRINT "ERROR": GOTO 600
610 RETURN
1000 REM. SUBR. TO READ LINE OF TEXT FROM KEYBOARD TO L$
1010 INPUT L$
1020 RETURN
2000 REM. SUB TO DO PB=INSTR(L$,F$) (OFFSET=0)
2070 IF LEN(L$) < LEN(F$) THEN PB=0: RETURN
2090 FOR PB=1 TO LEN(L$)-LEN(F$)+1
2100 IF MID$(L$,PB,LEN(F$))=F$ THEN RETURN
2110 NEXT PB: PB=0: RETURN
3999 REM ***** TAPE I/O SUBS :- 4000, 5000, 6000, 7000, 8000, 9000, 10000

```

Apple plotting

by J J Clessa

Here's a relatively simple routine which enables you to plot a variety of mathematical functions using the Apple II.

The function should be input in polar form but don't worry if you don't know what that means — you'll soon get the hang of it by trial and error. Enter the function in line 200 and set the size control parameter A in line 10. Increase A to make the graph bigger or decrease A to make it smaller.

By experimenting with different functions and different values of A,

you'll be able to create a variety of interesting curves. You might like to try these for starters:

$R = A * (1 - \cos(T))$ (A=50)
 $R = \text{SQR}(A * A * \cos(2 * T))$ (A=100)
 $R = A$ (A=50)
 $R = A / T$ (A=150)
 $R = A * (1 + 2 * \cos(T))$ (A=25)
 $R = A * \text{SQR}(\tan(2 * T))$ (A=50)
 $R = A * \log(T)$ (A=20)
 and for the romantic,
 $R = A * (\cos(T - 1.57) \wedge 9 - 2)$ (A=25)
 while for something different try,

$R = A * \log(T / A)$
 (I've forgotten the A value for this last one so you'll have to experiment with it.)

The program calculates and plots the function of a range of T from 1^0 to 360^0 . A FOR...NEXT loop isn't used because of the Apple's ONERR feature, which is necessary here for functions which produce negative square roots and the like.

I'd be pleased to hear of any interesting shapes you discover.

```

1 ONERR GOTO 300
10 A = 25
100 X9 = 135: X1 = - X9: Y9 = 75: Y1 = - Y9
110 T1 = 1 / 3.1415926: T9 = 360 * T1: T0 = T1
120 HGR : HOME : HCOLOR = 3: VTA(24): LIST 200
130 HPLOT X9.1 TO X9.2 * Y9: HPLOT 1, Y9 TO 2 * X9, Y9
190 T = T1
200 R = A * LOG (T / A)
210 X = INT (R + COS (T)): Y = INT (R * SIN (T))
220 IF X < X1 THEN 270
230 IF X > X9 THEN 270
240 IF Y < Y1 THEN 270

```

```

250 IF Y > Y9 THEN 270
260 HPLOT X + X9, Y + Y9
270 T = T + T0
280 IF T <= T9 THEN 200
290 STOP
300 E1 = PEEK (222)
310 E2 = PEEK (218) + PEEK (219) + 256
320 T = T + T0
325 IF E1 < > 53 THEN 340
330 RESUME
340 PRINT "ERROR CODE ": E1: " AT LINE ": E2
350 STOP

```

Lprint to print utility

This utility directs output from the lineprinter to the monitor (or vice versa) of your TRS-80 Level II. Just load or type it in and run it prior to execution of the program which is sending all that info. to the wrong place — and possibly hanging up your system.

```

20 A$=INKEY$: IF A$="" THEN 20 ELSE A=VAL (A$)
25 ON A GOTO 30,40,50
30 POKE16422,88: POKE16423,4: NEW
40 POKE16414,141: POKE16415,5: NEW
50 POKE16422,141: POKE16423,5: POKE16414,8
8: POKE16415,4: NEW

```

```

2 CLS
4 PRINT "          LPRINT TO PRINT OR PR
INT TO LPRINT UTILITY"
10 PRINT: PRINT: PRINT "PLEASE INDICATE DES
IRED MODIFICATION :-": PRINT
12 PRINT "LPRINT TO PRINT ----- TYPE 1
14 PRINT "PRINT TO LPRINT ----- TYPE 2
16 PRINT "NORMALIZE ----- TYPE 3

```

Have a peek....

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PROGRAMS

Star trek

written by Robert O'Connor

Some weeks ago, an extremely well written Star Trek program for a Level II 16K TRS-80 arrived at our office. As the program occupies 13K, the listing is too long to be published but

we would like to make it available to readers of APC. So if you're interested send a (large) S.A.E. to Star Trek Listing, APC, P.O. Box 115, Carlton, 3053.

ZX80 Breakout

by K I Allsop

The aim is to remove a complete column of five bricks in as few attempts as possible. Brick removal is based on time because the screen is invisible

while the ZX80 is thinking. Hit 'return' when you think it's time to fire the missile at the wall.

```
10 LET F=0
20 LET G=0
30 DIM B(160)
40 FOR A=1 TO 160
50 LET B(A)=1
60 NEXT A
70 PRINT, "BREAKOUT"
80 PRINT
90 PRINT
100 FOR A=1 TO 160
110 IF A=F THEN PRINT "*";
120 IF A=F THEN GOTO 150
130 IF B(A)=1 THEN PRINT " ";
140 IF B(A)=0 THEN PRINT " ";
150 NEXT A
160 FOR A=1 TO 32
170 FOR D=0 TO 4
180 LET E=A+D*32
```

```
190 IF B(E)=1 THEN GOTO 220
200 NEXT D
210 GOTO 320
220 NEXT A
230 LET G=G+1
240 POKE 16415,0
250 POKE 16414,0
260 INPUT A$
270 LET F=PEEK(16414)+PEEK(16415)*256-4
280 CLS
290 IF F>160 THEN GOTO 350
300 LET B(F)=0
310 GOTO 70
320 PRINT " "
330 PRINT, "BREAKOUT",G,"GOES"
340 INPUT W
350 PRINT "TIMEOUT"
```

Graph

by Ian O'Neill

This is a program written for the TRS-80 (with Level II Basic), which allows the user to plot any function y of x , which is expressible in the form $y = f(x)$, eg. $y = x^2 + 2x - 3$. Unlike many other programs, however, this program asks the user for the equation of the curve during the run.

The program listed here is the most recent, Mark IV version of the GRAPH programs I have written. It is also a specially 'shrunk' version, so that users with 4K of RAM can also implement it on their systems, with no adaptation. Earlier versions, did contain full instructions within the program, which could be accessed at any time - if you have 16K (or more) memory.

As well as defining any function (in 'Cartesian' explicit form), the user may also choose his own x-axis and y-axis limits, or choose his x-axis limits and then type 'AUTO', which then causes the computer to calculate upper and lower limits for y . These values, are not, however, guaranteed; they are based on values taken between the two x-limits at thrice the normal interval. They may also be inaccurate if the function is discontinuous at the lower x limit (eg. $y = 1/x$ at $x = 0$).

The Program

I managed to work out how the TRS-80's Level II Basic interpreter stores programs. It does so by searching each line as it is ENTERed, and converting any 'key words' into a single character, in the range 128-255 (ASCII code). Since these are characters which

cannot be typed at the keyboard, they are 'free' for this use, and any key word, such as PRINT, or RETURN, or CLEAR, can be stored as just one byte, instead of 5, 6 or 5 respectively. The codes for certain functions can be seen in line 40.

By examining the function that the user types (stored in string T), and converting the key words into their respective codes, the program produces a version of the formula which, if it were stored as a line of the program, the computer could use. The next step is to put this converted formula into a (purposefully) vacant line, line 500, which is full of '@' characters before the program is run. The computer looks through its memory starting at byte number 19000 (since this is convenient), and using the Basic function PEEK, examines each byte until it comes across one with an '@' in it. Then, if the following four bytes are also '@' (character 64), the computer has located the dummy line, and stores the address of the first byte of the line in the integer variable L. Later, using the command POKE, it can store the translated version of the formula in line 500, followed by a REM, so that the rest of the line (still full of '@'s) is ignored.

The program itself is composed as follows:

Lines 10-30 finds dummy line 500; 40 stores functions and their Level II codes in arrays V & R;

50-100 gets function from user, converts, and pokes into 500;

110 asks if function is symmetric about

$y = 0$, eg. circle;

120-140 inputs limits, and checks their validity;

150-180 calculates automatic y limits (if requested);

190-270 control centre of program, which will process and act on a variety of single-character commands from the user;

280-340 plots graph of current function within current x and y limits;

350-360 error routine, for checking validity of formula, and location of discontinuities;

370 end of program - re-initializes line 500;

500-510 subroutine to calculate y given x - function stored in line 500 by program.

The program itself, in this 'compressed' form, occupies under 2400 bytes of memory; a further 400 bytes are reserved for string storage, and this leaves sufficient room for the storage of numeric variables, even on a 4K system.

Using the Program

When you run the program, the computer, after a slight pause while it locates line 500, will ask you to type the function, y , in terms of x . You may use any of the 5 arithmetic functions +, -, *, / and I, also parentheses, (,), any numeric constants, eg. 5, 3.141593, 1.41421E-06, (or function thereof), and any of the standard Basic library functions, ie. SGN, INT, ABS, RND, SQR, LOG, EXP, SIN, COS, TAN and ATN. The function should be typed

in such a form that, were it typed as a line of a Basic program, it would be valid. Spaces may not be typed if the program is used as it stands without adaptation, nor any other characters not appearing above.

Once you have typed the function, you will be asked whether or not you wish the function to be symmetrical about the x-axis, to which you should answer "YES" or "NO" ("Y" or "N" will suffice). This allows, for example, for the plotting of conic sections. Incidentally, to plot a circle which looks like a circle requires a bit of 'fiddling' with the limits, or you end up with an ellipse!

The next stage is to type the limits. You must first type the lower and upper x limits, and then you will be asked for the lower y limit. You may type "AUTO"; if you do the latter, the computer will calculate its own y limits, and after a slight pause (whose length depends upon the complexity of the function), it will display these. If you type anything but "AUTO", however, the computer will take the value of whatever you type; so if you type "A" or any non-number, the computer assumes the value zero. If you do not request AUTO y limits, the computer will also ask for an upper y limit, of course.

Once you have typed limits, a

flashing cursor will appear, indicating that you may now issue any of the following commands, simply by pressing the appropriate letter;

D Display limits (displays limits on top line of screen);

F display Function (again, on top line of screen);

L insert new Limits;

N New function (allows you to plot a different function);

P Plot (plots current function within current limits);

```
# End program.
```

The last character is a top line shift character, so that it cannot be pressed accidentally. Depression of any other key will cause the computer to display a question mark(?) for a short time, to indicate that you have pressed a 'wrong' key.

Whenever you wish to cease using the program, you should terminate your usage via the “#” -key, as this way the computer pokes “@’s into line 500 again, so that the program can be run again straight away. If you leave the program by pressing the “break” key, however, the last function you used will remain resident in line 500, and if you attempt to run the program again, either the computer will miss line 500 altogether, or instead it will poke your new function into line 500 after the REM statement poked into line 500 by

the previous run, and you will instead get graphs of the last function you typed on the previous run.

If you do break out of the program, you can change line 500 to its initial condition again manually, by editing line 500 and changing the first 5 or more characters into "@" characters, or by retyping line 500 altogether.

Note that, whenever you plot the function you are currently using, if either or both of the axes occur within the limits set, they will be plotted – this is done on lines 290 and 300, which can be removed if you do not want axes (or you would adapt the program to ask whether or not axes are required).

Finally, here are some graphs to try, if you're at a loss for ideas:

$Y = \sqrt{X^2 - 1}$ (hyperbola) Yes to symmetry;

Y@SQR(1- X*X) (circle/ellipse) Yes to symmetry;

Y=SQR(X) (parabola) Yes to symmetry;
Y=SIN(X), Y=COS(X), Y=TAN(X),

$$Y = ATN(X).$$
$$Y=1/\sin(X), \text{ etc. } Y=1/X, Y=X^3, \\ Y=\exp(X), Y=\log(X)$$

$Y = \exp(-.1 * X) * \sin(X)$ try limits of
x = 0 to 19, y = -.1 to 1.

$$Y = (X-1) * (X-2) * (X-3) * (X-4)$$

try
x = .8 to 4.2, y AUTO.

and so on.

I. O'Neill

```

30 CLEAR#00: GLS:PRINT#474,"PLEASE WAIT.?:DEFINT A-P:DEFSTR Q-W:ONERORGO
TO 350:FOR L=19900 TO 20000:IFEEK(L)=64 THEN EN30
20 NEXT L:PRINT#471,"NO DUMMY LINE 500.?:END
30 FOR I=10L+4:IFEEK(J)=64 THEN EN30 ELSE2
40 DIM V(20),R(20):FOR J=0 TO 20:READ V(J),I:(R(J)-CHR$(I)):NEXT DATA+.205,
.206,+.207,+.208,+.209,+.210,+.211,+.212,+.213,+.214,+.215,+.216,+.217,+.218,+.219,+.220,+.221,+.222,+.223,+.224,+.225,+.226,+.227,+.228,+.229,+.230,+.231,+.232,+.233,+.234,+.235,+.236,+.237,+.238,+.239,+.240,+.241,+.242,+.243,+.244,+.245,+.246,+.247,+.248,+.249,+.250,+.251,+.252,+.253,+.254,+.255,+.256,+.257,+.258,+.259,+.260,+.261,+.262,+.263,+.264,+.265,+.266,+.267,+.268,+.269,+.270,+.271,+.272,+.273,+.274,+.275,+.276,+.277,+.278,+.279,+.280,+.281,+.282,+.283,+.284,+.285,+.286,+.287,+.288,+.289,+.290,+.291,+.292,+.293,+.294,+.295,+.296,+.297,+.298,+.299,+.300,+.301,+.302,+.303,+.304,+.305,+.306,+.307,+.308,+.309,+.310,+.311,+.312,+.313,+.314,+.315,+.316,+.317,+.318,+.319,+.320,+.321,+.322,+.323,+.324,+.325,+.326,+.327,+.328,+.329,+.330,+.331,+.332,+.333,+.334,+.335,+.336,+.337,+.338,+.339,+.340,+.341,+.342,+.343,+.344,+.345,+.346,+.347,+.348,+.349,+.350,+.351,+.352,+.353,+.354,+.355,+.356,+.357,+.358,+.359,+.360,+.361,+.362,+.363,+.364,+.365,+.366,+.367,+.368,+.369,+.370,+.371,+.372,+.373,+.374,+.375,+.376,+.377,+.378,+.379,+.380,+.381,+.382,+.383,+.384,+.385,+.386,+.387,+.388,+.389,+.390,+.391,+.392,+.393,+.394,+.395,+.396,+.397,+.398,+.399,+.400,+.401,+.402,+.403,+.404,+.405,+.406,+.407,+.408,+.409,+.410,+.411,+.412,+.413,+.414,+.415,+.416,+.417,+.418,+.419,+.420,+.421,+.422,+.423,+.424,+.425,+.426,+.427,+.428,+.429,+.430,+.431,+.432,+.433,+.434,+.435,+.436,+.437,+.438,+.439,+.440,+.441,+.442,+.443,+.444,+.445,+.446,+.447,+.448,+.449,+.450,+.451,+.452,+.453,+.454,+.455,+.456,+.457,+.458,+.459,+.460,+.461,+.462,+.463,+.464,+.465,+.466,+.467,+.468,+.469,+.470,+.471,+.472,+.473,+.474,+.475,+.476,+.477,+.478,+.479,+.480,+.481,+.482,+.483,+.484,+.485,+.486,+.487,+.488,+.489,+.490,+.491,+.492,+.493,+.494,+.495,+.496,+.497,+.498,+.499,+.500,+.501,+.502,+.503,+.504,+.505,+.506,+.507,+.508,+.509,+.510,+.511,+.512,+.513,+.514,+.515,+.516,+.517,+.518,+.519,+.520,+.521,+.522,+.523,+.524,+.525,+.526,+.527,+.528,+.529,+.530,+.531,+.532,+.533,+.534,+.535,+.536,+.537,+.538,+.539,+.540,+.541,+.542,+.543,+.544,+.545,+.546,+.547,+.548,+.549,+.550,+.551,+.552,+.553,+.554,+.555,+.556,+.557,+.558,+.559,+.560,+.561,+.562,+.563,+.564,+.565,+.566,+.567,+.568,+.569,+.570,+.571,+.572,+.573,+.574,+.575,+.576,+.577,+.578,+.579,+.580,+.581,+.582,+.583,+.584,+.585,+.586,+.587,+.588,+.589,+.590,+.591,+.592,+.593,+.594,+.595,+.596,+.597,+.598,+.599,+.600,+.601,+.602,+.603,+.604,+.605,+.606,+.607,+.608,+.609,+.610,+.611,+.612,+.613,+.614,+.615,+.616,+.617,+.618,+.619,+.620,+.621,+.622,+.623,+.624,+.625,+.626,+.627,+.628,+.629,+.630,+.631,+.632,+.633,+.634,+.635,+.636,+.637,+.638,+.639,+.640,+.641,+.642,+.643,+.644,+.645,+.646,+.647,+.648,+.649,+.650,+.651,+.652,+.653,+.654,+.655,+.656,+.657,+.658,+.659,+.660,+.661,+.662,+.663,+.664,+.665,+.666,+.667,+.668,+.669,+.670,+.671,+.672,+.673,+.674,+.675,+.676,+.677,+.678,+.679,+.680,+.681,+.682,+.683,+.684,+.685,+.686,+.687,+.688,+.689,+.690,+.691,+.692,+.693,+.694,+.695,+.696,+.697,+.698,+.699,+.700,+.701,+.702,+.703,+.704,+.705,+.706,+.707,+.708,+.709,+.710,+.711,+.712,+.713,+.714,+.715,+.716,+.717,+.718,+.719,+.720,+.721,+.722,+.723,+.724,+.725,+.726,+.727,+.728,+.729,+.730,+.731,+.732,+.733,+.734,+.735,+.736,+.737,+.738,+.739,+.740,+.741,+.742,+.743,+.744,+.745,+.746,+.747,+.748,+.749,+.750,+.751,+.752,+.753,+.754,+.755,+.756,+.757,+.758,+.759,+.760,+.761,+.762,+.763,+.764,+.765,+.766,+.767,+.768,+.769,+.770,+.771,+.772,+.773,+.774,+.775,+.776,+.777,+.778,+.779,+.780,+.781,+.782,+.783,+.784,+.785,+.786,+.787,+.788,+.789,+.790,+.791,+.792,+.793,+.794,+.795,+.796,+.797,+.798,+.799,+.800,+.801,+.802,+.803,+.804,+.805,+.806,+.807,+.808,+.809,+.810,+.811,+.812,+.813,+.814,+.815,+.816,+.817,+.818,+.819,+.820,+.821,+.822,+.823,+.824,+.825,+.826,+.827,+.828,+.829,+.830,+.831,+.832,+.833,+.834,+.835,+.836,+.837,+.838,+.839,+.840,+.841,+.842,+.843,+.844,+.845,+.846,+.847,+.848,+.849,+.850,+.851,+.852,+.853,+.854,+.855,+.856,+.857,+.858,+.859,+.860,+.861,+.862,+.863,+.864,+.865,+.866,+.867,+.868,+.869,+.870,+.871,+.872,+.873,+.874,+.875,+.876,+.877,+.878,+.879,+.880,+.881,+.882,+.883,+.884,+.885,+.886,+.887,+.888,+.889,+.890,+.891,+.892,+.893,+.894,+.895,+.896,+.897,+.898,+.899,+.900,+.901,+.902,+.903,+.904,+.905,+.906,+.907,+.908,+.909,+.910,+.911,+.912,+.913,+.914,+.915,+.916,+.917,+.918,+.919,+.920,+.921,+.922,+.923,+.924,+.925,+.926,+.927,+.928,+.929,+.930,+.931,+.932,+.933,+.934,+.935,+.936,+.937,+.938,+.939,+.940,+.941,+.942,+.943,+.944,+.945,+.946,+.947,+.948,+.949,+.950,+.951,+.952,+.953,+.954,+.955,+.956,+.957,+.958,+.959,+.960,+.961,+.962,+.963,+.964,+.965,+.966,+.967,+.968,+.969,+.970,+.971,+.972,+.973,+.974,+.975,+.976,+.977,+.978,+.979,+.980,+.981,+.982,+.983,+.984,+.985,+.986,+.987,+.988,+.989,+.990,+.991,+.992,
```

[illegible]

BLUDNERS

Just as we were patting ourselves on the back for a comparatively Blunder-free August issue, the September APC arrived. In case you hadn't noticed (and for the frustrated reader who rang up begging for a clue in the imagined 'spot

the difference puzzle') pages 34 and 35 were identical. Anyone wanting a copy of the intended page 35, just drop us a line.

Pages 23 and 25 of Computer Games were somehow transposed; also make the

following changes to Blinking Cursor in Tandy Tips: line 130 should read

FOR INDEX = 1 to 56
and line 210 should begin with DATA
229, not DATA 220.

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